

FAO FISHERIES BULLETIN

Volume IX, Number 2

April-June 1956

CONTENTS

ANTARCTIC AND SUB-ARCTIC MARINE RESOURCES	63
FISHERIES OF ANTARCTICA	79
PROBLEMS OF FISH MARKETING IN THE INDO-PACIFIC REGION	85
REGULATION FOR THE FISHING INDUSTRY OF THE FEDERAL REPUBLIC OF GERMANY	92
INTERNATIONAL TRAINING CENTRE IN INLAND FISHERIES AND FISH CULTURE, INDONESIA	96
CONFERENCES AND MEETINGS	97
Meeting of Inland Fisheries Advisers	97
ECE Working Group on Standardization of Perishable Foodstuffs	97
2nd FAO Consultants Meeting on Documentation and Related Services for Fisheries Biology	98
International Commission for the Northwest Atlantic Fisheries. Standing Committee on Research and Statistics	100
FISHERIES DIVISION ACTIVITIES	101
REPORTS ON FILMS	105
CURRENT FISHERIES LITERATURE	107

Editor: D. B. Finn

The *FAO Fisheries Bulletin* is prepared by the staff of the Fisheries Division and is published in English, French and Spanish. The contents have not been copyrighted and may be reprinted freely, reference to source will be appreciated. Annual subscription: U.S. \$1.00; single copy: 30 cents; orders are payable in local currencies when orders are placed through local sales agents. See inside back cover for list of sales agents.

Opinions expressed in signed articles by non-FAO staff members are not necessarily those of the Organization.

Reprints of feature articles are available from FAO Headquarters, Rome, Italy.

Printed in Italy

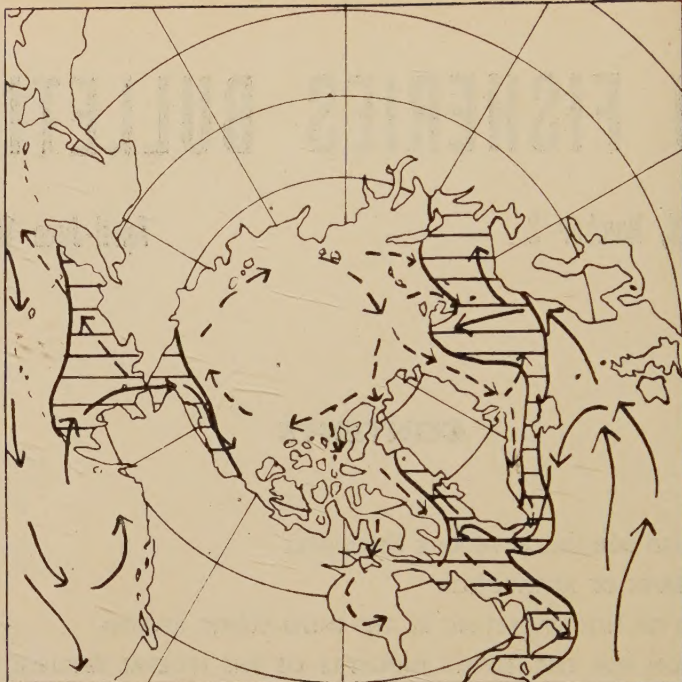


Figure 1. Zones of marine environment and main surface currents

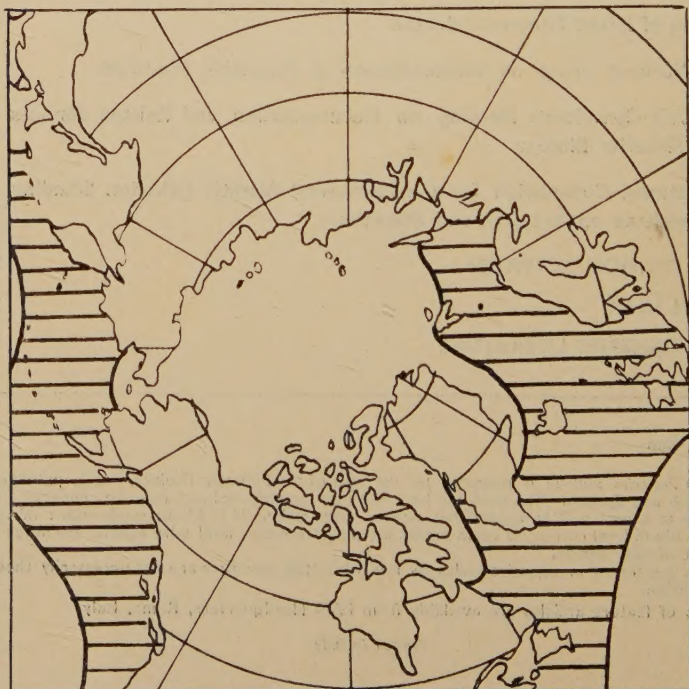
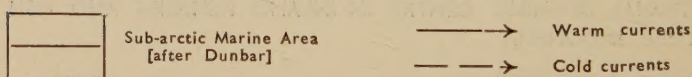
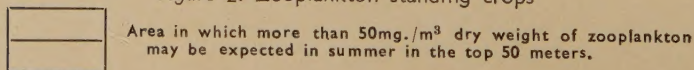


Figure 2. Zooplankton standing crops



ARCTIC AND SUB-ARCTIC MARINE RESOURCES*

For centuries the seamen of Europe and America have known that the cold northern seas were teeming with life. They have sailed as far as the ice edge to catch whales, and later, when the whales had gone, to catch fish and seals. In the last 50 years marine biologists and hydrographers have turned their attention to northern waters to learn more about the animals and the waters in which they live. And more recently fisheries scientists have been trying to find how the resources of these seas can best be used for the benefit of mankind. This article is a survey of our knowledge of these resources.

Definition and Description of the Area

The terms "arctic" and "sub-arctic" which will be used, apply only to the seas and they have the meanings defined by Dunbar (5). The marine "arctic" is the area in which polar water is found in the top 650 to 1,000 ft. (200 to 300 m.) and the "sub-arctic" is defined as the area in which the upper layers are of mixed polar and non-polar origin. Most of this non-polar water is of Atlantic origin, and in the Atlantic sector the sub-Arctic extends from the Gulf of St. Lawrence to the Kara Straits, including the waters around Newfoundland, Labrador, West Greenland, the north of Iceland, most of the Norwegian Sea, part of the Greenland Sea, and the Barents Sea. In the north Pacific, the sub-arctic includes the Bering Sea and the coastal waters of north Alaska. The southern boundary of the marine sub-arctic varies seasonally and with the state of the climatic cycle. The true arctic waters include the North Polar Basin, north of Russia, Canada and Greenland, and most of the East Greenland waters.

The Polar Basin is an elongated depression surrounded by wide continental shelves. The major axis of the Basin from Spitzbergen to Alaska is 1,600 miles (2,600 km.) and the minor axis 1,000 miles (1,300 km.) across. It was formerly considered as one deep basin, but recent Russian exploration has shown that it is divided by the Lomonsov Range, which stretches for 1,100 miles (1,750 km.) from the New Siberian Islands across the North Pole to Greenland and Ellesmere Land (15). In some places the steep-sided peaks of this range rise to within 3,100 ft. (950 m.) of the surface, and there are saddles at depths of about 4,950 to 5,250 ft. (1,500 to 1,600 m.). The widest and deepest "deep" is that north of the Barents and Kara seas with a maximum depth of over 7,100 ft. (5,220 m.). The smaller deep on the other side of the

* By John Corlett, Ministry of Agriculture, Fisheries and Food, Fisheries Laboratory, Lowestoft, England.

ED. NOTE: Conversions are rounded figures.

range goes to 13,100 ft. (4,000 m.) and a third, north of the Chuckchee and Beaufort seas, down to 12,550 ft. (3,820 m.). Most of this basin is covered with ice the whole year round.

The second large arctic/sub-arctic basin is that of the Norwegian and Greenland seas, bounded in the south by a ridge from Greenland through Iceland and the Faroes to Scotland, and on the north by a saddle with a depth of 4,950 ft. between Spitzbergen and Greenland. This basin has two deeps, north and south of a ridge which includes the island of Jan Mayen. A third basin is Baffin Bay between Baffin Land and Greenland which has depths of over 6,550 ft. (2,000 m.) and a sill depth of 2,300 ft. (700 m.).

The continental shelf of the Siberian coast is up to 500 miles (800 km.) wide and is very shallow with a 165 ft. (50 m.) depth contour about 300 miles (500 km.) from land. Off Alaska and the Canadian archipelago the shelf is between 50 and 100 miles (80 to 160 km.) wide. North of Europe the Barents Sea covers 400,000 sq.mi. (1,036,000 km²) to Spitzbergen and Franz Joseph's Land in the north and Novaya Zemlya in the east, with a mean depth of about 650 ft. The Bering Sea covers 860,000 sq.mi. (2,227,000 km²) between the Aleutian Islands and the coasts of Alaska and Siberia; about half of this area in the east and north is a flat continental shelf less than 650 ft. deep. The connection through the Bering Straits to the Polar Basin is 50 miles wide and only 165 ft. deep.

II. *Physical Oceanography*

The main features of the circulation of the Arctic Ocean are a surface outflow of cold water of low salinity, and a subsurface inflow of warmer and more saline Atlantic water. The principal exchange takes place between Spitzbergen and Greenland, and the other openings are too narrow and too shallow to be important. The cold surface water flows down the whole length of the east Greenland coast and a branch of it contributes to the circulation of the Norwegian Sea, north of Iceland. This East Greenland Current carries a large amount of ice and has a widespread influence on the oceanography and meteorology of the North Atlantic. Atlantic water from the Gulf Stream and the North Atlantic Drift system, enters the Norwegian Sea between the Faroes and Shetlands and flows northwards along the west coast of Norway. North of Norway it branches, one branch flowing north past Bear Island and along the west coast of Spitzbergen until it submerges below the cold polar water in about 80° N.; it then spreads out as a subsurface layer over most of the Arctic Ocean.

The Polar water is characterized by a temperature of about 29.3° F. (-1.5° C.) throughout the year and a salinity of less than 33‰. The low salinity of the surface layers is caused by the discharge of fresh water from the rivers of Siberia and Canada and Alaska. The effect of the rivers is most marked in summer

when, for instance, salinities as low as $30/_{00}$ may be found 60 miles (95 km.) from the River Lena. In summer, the melting ice reduces the salinity of the surface and increases the temperature to 32° F. (0° C.), while at 65 to 100 ft. (20 to 30 m.) it remains less than 30.2° F. (-1° C.). The surface layer is very distinct over the East Siberian Shelf.

The Atlantic water of the West Spitzbergen Current has a temperature between 37° and 43° F. (3° and 6° C.) and a salinity about $350/_{00}$. Off the north coast of Norway a branch of the current flows into the Barents Sea and along the Murman coast, while other branches spread out and mix with the colder water entering the sea from the northeast. The seasonal variations of the boundaries and mixing of the two types of water have a great influence on the biology and location of the fisheries in the Barents Sea (9).

The main features of the circulation of the Norwegian and Greenland seas are the two currents already mentioned — the warm northward-flowing Atlantic water in the east and the cold East Greenland Current in the west. Both these currents have branches and eddies which meet and mix. The positions of the boundaries between the different types of water are very important for the herring fisheries in the Norwegian Sea (4).

The cold water flowing out of the Greenland Sea through the Denmark Straits meets a current of warm Atlantic water known as the Irminger Current coming from the east, south of Iceland. The cold and warm currents flow south along the coast of Greenland and mix at their boundary. At Cape Farewell they turn northward along the west coast of Greenland and over the banks. Here again the relative strengths and positions of the components of the current are important to the fishermen (10). Part of this current flows through the Davis Straits and into Baffin Bay, but most of it turns west and then south along the border of the cold Labrador Current of arctic water which flows southwards along the coasts of Baffin Land and Labrador. The cold Labrador Current flows north of Newfoundland and on to the Grand Bank. South of the Grand Bank the warm Gulf Stream flows eastward, and where the cold and warm currents meet and mix there are great fisheries (13). Among the islands of the Canadian Archipelago the water is polar in origin and mostly flows from the north and west into Baffin Bay.

Although the flow of water through the Bering Straits is small, the Bering Sea may be considered a sub-arctic area since much of it freezes over during the winter. The northern and eastern half of the sea is less than 650 ft. deep and is covered with water between 32° and 43° F. in summer. In this sea, too, the distribution of cold and warmer water influences the distribution of the fisheries (6). The balance of the current through the Bering Straits is from the Pacific into the Chuckchi and Beaufort seas and along the northern coast of Alaska.

III. Ice

The Arctic and parts of the sub-arctic seas are covered with ice in winter — this reaches its greatest extent about April, when the whole of the Arctic Ocean is usually covered to the coastline of Siberia, Alaska and the Canadian Archipelago, as well as the eastern and northern parts of the Bering Sea. Baffin Bay is filled with ice which extends along the coast of Labrador and sometimes covers the Grand Banks. The ice of the East Greenland Current may reach to Jan Mayen and fill the northern part of the Denmark Straits. Further south it stretches up to 50 miles off the coast and round Cape Farewell and for 100 to 200 miles along the west coast of Greenland. More than half the Barents Sea may be covered by ice at its maximum extent. By the end of the summer, in September, the ice edge has retreated all along its edge; the north Siberian coast may be free, allowing navigation along Russia's "northern sea route," and the "north west passage" may be navigated along the coast of Canada and Alaska. The Bering Sea is ice-free. And only a small island of ice may be left in Baffin Bay. The east Greenland coast is ice-free from Cape Farewell to 250 miles (400 km.) north of the Denmark Straits; the whole of the Barents Sea is ice-free, the ice edge retreating up to 300 miles in the central part of the sea. It has been estimated (8) that at the present time nearly half the ice masses round the Arctic in winter may have melted by the end of the summer.

It should be emphasized that the extent of the ice cover both in winter and summer varies considerably from year to year, also from decade to decade. During the present cycle of warming of the arctic, which began in the 1920's, the areas of the arctic and sub-arctic that are ice-free in summer are considerably larger than were those of the first two decades of the century.

As shown in the next section, the seasonal changes in ice cover have a profound effect on the production of plants and animals in the sub-arctic. And the changes from decade to decade have caused changes in the size and distribution of the fish stocks and in their availability to fishermen (12).

IV. Primary Production and Plankton

Those who have sailed on northern seas usually remark on the abundance of life in the sub-arctic and its comparative scarcity in the true arctic. Various ideas to account for this difference have been suggested, such as differences in temperature or dissolved nutrient salts or the molecular structure of the water, and it has been suggested that arctic water has a high potential fertility which is only released on mixing with other waters (5).

Most of the organic matter synthesized in the sea is produced by tiny floating plants collectively known as phytoplankton. The conditions for the production of phytoplankton in the seas have been discussed by Sverdrup (11). The two main requirements

are light and dissolved nutrient salts, particularly phosphates and nitrates. There is sufficient light for the photosynthesis only in the upper layers of the sea; in high latitudes this "euphotic" zone extends down no further than 165 or 200 ft. because of the low angle of the sun. However, in summer there are long hours of daylight — but during the arctic winter there is no light for photosynthesis. The main obstacle to light reaching the plants in the northern seas is the ice cover. Sunlight can penetrate pure ice, but 10 in. (25 cm.) of cloudy sea ice lets through only about 10 percent of the surface light, and a thin snow cover is sufficient to reduce this to almost zero. Thus, underneath the polar ice there can be little or no plant production until late summer when the snow has melted and the ice thinned, and the main production in the Arctic Ocean must take place in the leads between the floes.

To be able to grow and reproduce, the plants must stay in the euphotic zone and not sink or be carried down to the deeper darker parts of the sea. Two conditions allow this: firstly, if the euphotic zone extends to the bottom as it may do on shallow banks such as the center of the Spitzbergen Bank, and secondly, if the upper layer of the sea is separated from that below by a discontinuity layer through which mixing does not take place. The second condition is found in temperate oceans where a warm, less dense, surface layer develops in summer, or where rivers discharge large volumes of fresh water which lie on top of the salter, denser water, or where melting ice forms a lighter, fresher, cold surface layer. In this layer of melt water, which may be 30 or 65 ft. (10 or 20 m.) thick, phytoplankton can develop rapidly. This occurs in the leads in the polar ice, but in the sub-arctic it can happen over the whole area from which the ice recedes. Thus, phytoplankton "flowering" takes place in the sub-arctic from April onwards, whereas in the Arctic Ocean, it is poor until July and rich only in August, when the ice cover is reduced.

The second requirement for phytoplankton production is an adequate supply of nutrients. The deeper waters of the northern seas are rich in nutrients which are brought to the surface when winter cooling causes mixing of the waters or, as Sverdrup calls it "deep plowing" (11). The nutrients in the thin surface layer of melt water may be rapidly used by the plants, but recent observations in the Barents Sea from the Research Vessel *Ernest Holt*, suggest the possibility of renewal in areas where the ice edge recedes in spring and summer. The ice edge does not recede steadily in one direction but may be blown to and fro by gales over one area several times: after the initial flowering in the melt water the water column may be stirred up, renewing the nutrients supply at the surface. When the ice recedes again another flowering can take place in the melt water, and so on as the ice edge fluctuates, thus making the best use of the nutrients. The areas of most plant production should therefore be those from which the ice recedes between March and August.

The mixing of currents of different temperatures and salinities is also an effective way of distributing nutrients, as seen on the Grand Bank where the Labrador Current meets the Gulf Stream.

Although the species of plants found in the cold arctic differ from those in warmer temperate waters, low temperature seems to have little ill-effect on the production of phytoplankton. Cold has more effect on the animals.

The animals of the zooplankton feed on phytoplankton. Many of them, such as the copepods which make up the main bulk of zooplankton in all the oceans, feed directly on the plants, but some feed on decaying plant and animal matter known as *detritus* and some others are carnivores. In the arctic and sub-arctic the animals must be able to reproduce at low temperatures and to survive the winter when food is scarce. There has been little research on the zooplankton of the Arctic Ocean, but some has been done in the sub-arctic. *Calanus finmarchicus* is the commonest copepod in the sub-arctic and its life history in the Barents Sea may be taken as an example. Spawning takes place south of the ice edge at about the time of the phytoplankton production, mainly between April and June: the new brood has developed to the last pre-adult stage by October and stored enough fat to last over the winter. Successive spawning follows the retreating ice to the north and in the far north early juvenile stages are found in October: it seems unlikely that these would survive the winter. Development is slower in the colder water and this later and slower development and scarcity of food would combine to make the arctic waters poorer in zooplankton than the sub-arctic.

Calanus has been taken as an example but a similar pattern of spawning is found among the Auphausiids which are probably second in importance among plankton animals in the sub-arctic, where they usually live for two years. They feed directly on phytoplankton and on detritus. Other common members of the zooplankton are Hyperiid amphipods of the genus *Themisto*, the Pteropods *Limacina* and *Clione* and the predatory arrow worms and medusae. Animals often grow larger in colder conditions and most of the plankton animals in the colder waters are larger than their relatives in the warmer oceans. Also, in colder waters there are fewer species belonging to any one group, but large numbers of animals of each species.

Thus, it will be seen that the richest areas in the northern seas should be the places where the ice retreats between April and August; this has been observed as generally true at least in the Barents Sea, the Norwegian Sea (16) and in Greenland waters.

V. Bottom Living Animals

The animals which live on the sea bottom, known collectively as the "benthos," belong mostly to four main groups, the mollusks, (whelks, clams, mussels, etc.), echinoderms (starfish, sea ur-

echinoderms and sea cucumbers), crustacea, such as prawns and shrimps, and worms. They are found in greatest quantities on the shallower banks; the edge of the continental shelf at 1,300 ft. (400 m.) depth is about the limit of benthos in quantity. Most of these animals feed on small particles of organic matter, which may be living plankton animals and plants, but are mainly detritus from dead plankton and from faeces which rain down from the upper layers. This feeding on detritus partly explains the scarcity of benthos at great depths, because, in the deeper oceans, much of the detritus will have decayed completely or will have been eaten before it reaches the bottom. The dependence of the benthos on production in the upper layers means that the benthos should be rich in areas of rich production. Brotskaja and Zenkevich (1) made a study of the distribution of the benthos in the Barents Sea and showed that the greatest quantity was found in the area of the "polar front" where there are "powerful encounters of warm and cold waters;" they showed that this happens also off Iceland and southwest Greenland. They stress the importance of vertical circulation of the waters near the polar front in providing optimal conditions of nutrition. The polar front areas are just those where the ice edge retreats in late spring and summer where it has been shown that maximum plankton production may be expected.

Benthic animals are the food of many bottom living, or "demersal" fish, such as the flatfish and haddock.

VI. Vertebrates

Mammals are the dominant vertebrates in arctic, and fishes in sub-arctic, seas. This does not mean that the mammals are absent from the sub-arctic; they are, in fact, more abundant there than in the arctic, but even so, they are outnumbered in the sub-arctic. Between the poverty of arctic waters and the richness of the sub-arctic, there is a very great difference in the number of fish.

The most important biological difference between the two groups is that seals and whales are warm blooded and can maintain a body temperature higher than that of the environment, while fishes are cold blooded and take up the temperature of the surrounding water. Therefore, in arctic water the blood of fishes is very near to freezing and, as it freezes at a slightly higher temperature than does sea water, many fishes may be prevented from entering the coldest water. Since the last glacial era the dispersal of fishes in the cold regions has been slower than that of mammals and, perhaps, more arctic fishes will yet evolve; but probably there is insufficient food to support large populations. Seals and whales have layers of fat which insulate their bodies against cold, and seals also have thick hair to protect them when on land. Another biological difference which is important when considering exploitation is the method of reproduction: seals and whales produce only one or two young per year, whereas a fish generally

spawns many thousands of eggs and so produces several hundreds of young fish.

Although mammals are dominant, only a few species remain in the Arctic throughout the year. The true arctic species are the walrus (*Odobenus rosmarus*), bearded seal (*Erignathus barbatus*), and ringed seal (*Phoca hispida*) and the narwhal (*Monodon monoceros*) and beluga or white whale (*Delphinapterus leucas*), and even the last two feed on the northern fringes of the sub-arctic on fish. The walrus and the two seal species feed mainly on shellfish and crustacea of the coasts and shallow banks and on the small polar cod (*Boreogadus saida*) also.

The next group of mammals migrate from the sub-arctic to the arctic in summer. This group includes the harp seal (*Phoca groenlandica*) and hooded seal (*Cystophora cristata*) and the rare Greenland whale (*Balena mysticetus*). The seals breed on the edge of the pack-ice when it is furthest south in March and April and they follow the ice northward during the summer, feeding on "krill" and fish, including polar cod. "Krill" is the name given by whalers to the swarms of Euphausiids, and sometimes Amphipods, which are the food of whalebone whales, such as the Greenland whale.

Two other whales, the fin whale (*Balaenoptera physalus*) and killer whale (*Orcinus orca*) probably spend most of their lives in the sub-arctic in both Atlantic and Pacific sections. The former feeds on krill and the latter on fish, seals and other whales.

The fur seals of the Pacific and five species of whales migrate into the sub-arctic during the summer; but, while fur seals come to breed, the whales come to feed and go south in winter to breed in the warmer waters. The fur seals (*Callorhinus* spp.) are fish eaters, but the whales feed mainly on krill and other plankton and sometimes on fish. The blue whale (*Balaenoptera musculus*), hump-back (*Megaptera novaeangliae*) and bottlenose (*Hyperoodon* spp.) are found in all parts of the sub-arctic, and the sei whale (*B. borealis*) and minke whale (*B. acutorostrata*) mainly in the Norwegian and Barents seas.

Fish are usually divided into "pelagic" and "demersal" species. Pelagic fish live in mid water and feed on plankton and usually swim in large shoals. The two most prolific pelagic species in the sub-arctic are capelin (*Mallotus villosus*) and herring (*Clupea harengus*). The capelin is the more northern of the two; it spawns along the coasts and feeds near the ice edge. Herring also spawn on the coastal banks and migrate northwards to feed.

The term "demersal" applies to fish caught near the sea bed; among them are the bottom living flatfish which do not make long migrations; for example, plaice (*Pleuronectes platessa*), long rough dab or American plaice (*Drepanopsetta platessoides*) and Greenland halibut (*Reinhardtus hippoglossoides*), which all feed on benthos, and halibut (*Hippoglossus* spp.) which feeds on fish and crustacea. Also classed as demersal fish are some which might better be called "bathypelagic" because they spend much time in mid-water; haddock

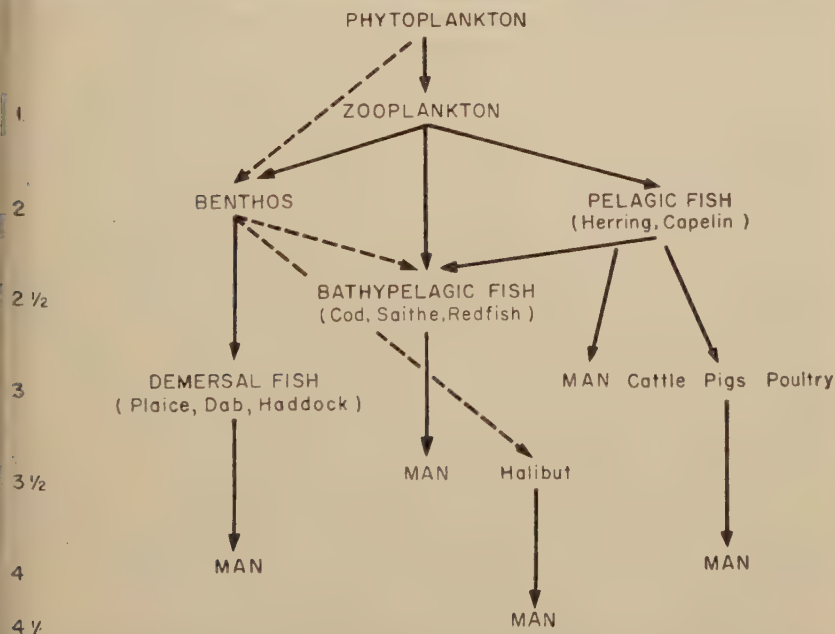
(*Gadus aeglefinus*) feed on the bottom, but cod (*G. callarias*), saithe or pollock (*G. virens*) and redfish (*Sebastes* spp.) feed on pelagic fish, krill and other zooplankton. All four species in the Atlantic sector make long spawning migrations to warmer waters and feed in the rich area of the sub-arctic, and all are also found in temperate waters; the related north Pacific species make much shorter migrations.

Some fish spend part of their lives in fresh water and part in the sea or river estuaries. Salmon (*Salmo* spp. and *Onchorhynchus* spp.) spawn in most of the large rivers which drain into the sub-arctic, and after the first few years of life, live in the sea and feed on planktonic crustacea and pelagic fish. Some species of char (*Salvelinus*) and whitefish (*Coregonus* and *Prosopium*) of the arctic rivers of Asia and America migrate in summer to the estuaries and coastal waters to feed.

VII. Food Chains in the Sub-arctic

This much simplified "food web" includes the most important fishes, but leaves out the mammals.

The numbers on the left of the food chain diagram are the stages by which the animals are removed from the primary production



of the phytoplankton (they represent the ecologists "trophic levels"). Thus zooplankton, which feeds on the plants, is one stage removed. The consumers of zooplankton are pelagic fish and the benthos, which are represented as 2 stages removed from the plants. Cod, redfish and saithe may be considered as $2\frac{1}{2}$ steps removed since

they have a mixed diet of larger zooplankton and pelagic fish : the relative importance of plankton and fish in the food varies with the place and the season, and cod will sometimes feed on benthos. At 3 stages removed from the phytoplankton are the flatfish and haddock, which feed on the benthos. Halibut live on the bottom and feed mainly on fish and larger crustacea and so may be at the $3\frac{1}{2}$ level.

Man is at the end of the chains at various levels. When he catches and eats pelagic fish he is 3 stages removed from the basic production. When he eats cod and redfish he may be said to be $3\frac{1}{2}$ stages removed. He is at level 4 when he eats demersal fish or when he makes fish meal out of pelagic fish and feeds it to cattle, pigs or poultry which he then eats. And he is $4\frac{1}{2}$ stages from the phytoplankton when he eats halibut.

In proceeding from stage to stage in the food chain there is a great reduction in the numbers of organisms. Ecologists call this a "pyramid of numbers" : at the base of the pyramid are the vast numbers of primary producers, in this case the phytoplankton. The numbers of herbivorous zooplankton are not so great, while still large. Next come the carnivores which prey on the herbivores, and the predators of the carnivores are at the top of the pyramid with the smallest numbers of larger animals. The pyramid may also be considered in terms of the total weight of organic matter at each level, or in terms of the production of organic matter at each level. It has been estimated that at each level about $\frac{9}{10}$ of the food consumed is used for metabolism and only $\frac{1}{10}$ is stored. The food value of each stage thus represents very roughly $\frac{1}{10}$ of that of the previous stage (2) and (7).

It follows that the nearer man is to the primary production the more efficiently, biologically, he is in exploiting the resources of the sea. The harvesting of plankton would theoretically be most efficient, but it presents great practical difficulties. In the food chains shown, man uses the resources most efficiently when he eats pelagic fish ; next in efficiency is the catching of cod and redfish, and so on, to the longest food chain, via the halibut. When using herring for meal man takes the sea's resources at a high level, but uses them for food less efficiently than if they were eaten fresh.

From the pyramid of numbers there should be considerably more pelagic fish than any others, fewer cod and redfish, and fewer still of the bottom living fish. The fewness of the demersal fish is accentuated by the fact that they live mostly on the continental shelf, which occupies only 15% of the sub-arctic area, while pelagic fish can also live over the deep water. This difference in numbers is reflected in man's catch of fish. It is much easier to catch fish on the bottom than in mid-water, but in the Norwegian and Barents seas in 1953, for instance, 35% of the catch was herring, 50% cod, saithe and redfish, and 7% haddock and plaice (all excluding the Russian catch) ; while in the North Sea, south of the sub-arctic, 68% of the catch in 1953 was herring.

The two factors, smaller numbers of fish because of the long food chain and ease of catching, help to explain why the bottom living fish, such as halibut and plaice, are most susceptible to over-fishing; next comes the haddock which feeds on the bottom, but does not always swim there, then the bathypelagic feeders, cod and redfish, and lastly, the least susceptible should be the pelagic fish such as herring and capelin. One must add to this that man esteems the flavor of the rarer fish more highly than that of the common ones — he seems to prefer halibut to cod, and plaice to herring.

VIII. Stocks and their Exploitation

The Eskimos have for centuries depended for their existence on catching seals and whales. Although many southern Greenlanders now make a living from fishing, in the north and in Canada marine mammals still play a very important part in the native economy. The animals which they use most for food, dog food, oil for heat and light, and leather, are the true arctic species, walrus, bearded seal, ringed seal, narwhal and white whale. The stocks of all these are small and, except possibly the white whale, are not increasing, and both the Danes and Canadians believe that there should be no increase in their exploitation. Walrus also live on the northwestern coasts of Alaska where killing is prohibited except by the natives for food. There are also walrus at Spitzbergen and Novaya Zemlya and on some islands off Siberia; the ringed seal is hunted in the White Sea and the white whale in the White and Kara seas, but their importance is chiefly to the native population.

The history of northern whaling is of the depletion of one stock after another until now there are few to be caught. The Greenland whale is almost extinct and its hunting is entirely prohibited by the International Whaling Commission. The main sub-arctic whaling for large whales for oil is now for fin whales in the Norwegian Sea from Norway, Iceland and the Faroes, and a few sei, sperm and blue whales are caught. The Norwegian "fishery" for small whales for meat is based on the minke whale in the Norwegian and Barents seas, although some bottlenose and killer whales are taken: the catching is supervised and licensed by the Norwegian Government. The North Pacific whaling off the Kurile Islands and Kamchatka is outside our present consideration.

The northern fur seals are confined to the Pacific and most of them come ashore to breed on the Pribilof Islands in the Bering Sea. The early history of fur sealing, like that of whaling, is of uncontrolled killing, but unlike whaling, conservation measures were introduced in time, and by the treaty agreement killing is controlled by the United States of America, and the size of the herd has increased. Research is in progress on whether the increase is detrimental to fish stocks of commercial importance. Only three-year-old males are taken; the main product is skins, but the carcasses are also used for oil and meal.

Sealing for "hair seals" takes place on the coasts of Newfoundland, Labrador and West Greenland, along the "west ice" in the Greenland Sea and the "east ice" in the Barents Sea. The most important species are the harp seal and hooded seal: young ones are killed during the breeding season on the coast and ice edge for their skins. The largest "fishery" was the Newfoundland one which has declined over the last 100 years, probably due to wanton killing. The "west ice" fishery also declined rapidly, but is still carried on by Norwegian vessels which also go to the "east ice" and sometimes to Newfoundland and Labrador.

We can now consider the fisheries for fish in a restricted sense. Many papers from which information has been gathered will not be mentioned individually: some are in the Report of the United Nations Conference on the Conservation and Utilization of Resources (14). The statistics are taken from publications of the International Council for the Exploration of the Sea (ICES), the International Commission for the Northwest Atlantic Fisheries and FAO (3): none of these includes the catch of the U.S.S.R. Some parts of the Iceland and Newfoundland areas included in the statistics are just outside the sub-arctic.

Historically, fishing by European countries in the sub-arctic has been chiefly for cod and herring, and for centuries these two species have been mainstays of the economy of Iceland and Norway. English fishermen have been interested in cod and plaice first off Iceland and then in the Barents Sea; Scotsmen fished for halibut off Iceland and Greenland, and the French, Spaniards and Portuguese for cod on the Newfoundland banks. Newfoundlanders have fished for cod on the Grand Bank, and the Pacific fishermen of the United States of America and Canada have been interested in halibut. These species are still the most important, with haddock and redfish being increasingly fished in recent years. In the ICES areas of Newfoundland, Greenland, Iceland and the Norwegian and Barents seas, in 1953, cod made up 55%, herring 18%, redfish and saithe each 7%, haddock 6%, and the flatfish 1% of a total catch of $2\frac{3}{4}$ million metric tons.

Before considering further the true marine species, mention should be made of salmon. The great salmon fisheries are on both sides of the North Pacific, near the mouths of large rivers when fish are "running" to the rivers to spawn. The main fisheries in the northeast are off the Fraser River and south of Alaska, regulated respectively by the International Pacific Salmon Fisheries Commission and the U.S. Government. The latter also controls the fishery in the Aleutian Islands and western Alaska. In the northeast, the coastal fisheries extend to the Gulf of Anadyr. A large salmon population lives its oceanic life in the central parts of the northern North Pacific and in the Bering Sea; southwest of the Aleutians this stock has recently been exploited by Japanese mother ships and drifters. The International North Pacific Fisheries Commission is now studying this population, and those

of other fish on the high seas, to see if regulation is necessary. There are also salmon fisheries on the Atlantic coasts of Canada and Newfoundland. The stocks in Europe are smaller and the fishing takes place chiefly in rivers, with a little commercial exploitation in estuaries. Arctic char are important in the economy of Eskimos round Hudson Bay ; more research is needed on the stock of this fish which might stand small commercial fisheries in the Canadian Arctic. Whitefish, which form the basis of estuarine fisheries in Siberia, are being increasingly exploited as the country is developed.

As might be expected from the consideration of food chains, flatfish contribute only a small part of the total catch of marine fish. The stocks of most species are small and isolated. Plaice in the southeastern Barents Sea and in Icelandic waters have been fished by English trawlers for 50 years : catches declined quickly after the first discovery of the grounds and again, after good fishing immediately following two world wars. This sensitivity is a sign of too much fishing : but in interpreting the decline in catches after an accumulation has gone it should be realised that few trawlermen go after the small stocks, when there are large catches of cod and haddock to be taken. Long, rough dabs occur widely in the Barents Sea, but few are landed in Europe, because there is no market : saving them would make a small additional contribution. This species is fished by Canadians on the Newfoundland banks where it is the chief among five species of "flounders" which are taken ; the flounder catch might be increased, but not greatly. Greenland halibut are caught occasionally in the Barents Sea and more commonly off Iceland and Greenland, and are landed by Germans and Greenlanders in small quantities. Various species of soles and flounders have been found in the eastern Bering Sea and they might support a larger fishery. In the western Bering Sea there are only a few small stocks of flatfish which are not considered of commercial importance.

The most valuable flatfish is the halibut, which is fished by lining in all areas ; and it is also taken by trawlers in the Atlantic sector where it is found from Newfoundland to Norway and is occasionally taken in the Barents Sea. Probably in all these places the stocks are about holding their own, but would be susceptible to more intensive fishing. The most important halibut fishery is in the northeast Pacific (south of the sub-arctic) extending into the Bering Sea. This fishery is strictly regulated by the International Pacific Halibut Commission and during the past 30 years of conservation, the catch and stock have increased considerably. The yield in the Bering Sea could probably be greater if the regulations made it more profitable to fish there.

Among gadoid fish cod is undoubtedly the most important. The range of the Atlantic cod extends from the State of Georgia to Novaya Zemlya. In the sub-arctic there are four main stocks : Arcto-Norwegian, Icelandic-South Greenland, West Greenland and Newfoundland-Labrador. Although they are largely distinct pop-

ulations there is some interchange between them ; the West Greenland population has become increasingly separated from Iceland during the warming of the Arctic in the last few decades. It is usually considered that during this warming the feeding area in all parts of the sub-arctic has increased and has allowed the stocks to increase. Everywhere cod is subjected to intensive fishing by trawling and lining, and purse seining has recently been introduced in the Norwegian Westfjord. Population studies are being made in the fisheries laboratories of several countries and so far they give no sign that the stocks are overfished. They might even stand limited, increased exploitation, particularly if the climatic trend continues, but an opinion may be hazarded that it is doubtful whether the Barents Sea stocks could stand the twofold increase in fishing planned by the Russians. The introduction of a minimum mesh size of 110 mm. for European trawlers in northern waters has helped to save many undersized fish of this and other species.

Haddock has a range similar to that of cod, but less extensive. In the north it does not go into such cold water to feed and its abundance in the Barents Sea seems to depend on whether the year is a " warm " or " cold " one hydrographically. Most trawlermen go after haddock rather than cod if they have a choice but, while they usually know where to find cod, they do not always hear of the more irregular appearance of haddock on the fishing grounds. Haddock is vigorously sought in the southern Barents Sea, off the Norwegian coast, round Iceland and on the southern part of the Newfoundland banks. If the warming of the Arctic continues, the haddock will probably extend its range further north and the stocks may increase.

The saithe or coalfish is a more southern fish than the haddock. It is common round Iceland and along the Norwegian coast, but only occasionally is it taken as far north as Bear Island ; south of Newfoundland seems to be the northern end of its range in the eastern Atlantic. It is fished in all three areas, but little is known of its stock and potentialities. Probably its spread into the sub-arctic will also depend on continued warming.

The Pacific cod is widely distributed in the northern Pacific and Bering Sea. There is local fishing on the Aleutian banks and occasional commercial fishing in the southeastern Bering Sea. Probably more could be taken from these areas. There is also extensive fishing along the Asian coasts ; Russian biologists say that the populations there are small local ones, sensitive to intensive fishing and need conservation.

The most northerly of the gadoid fishes is the small polar cod of the ice edge and arctic coasts, which is probably not worth trying to exploit.

Redfish seem to be widely distributed in the North Atlantic, living pelagically in the open ocean ; and they are found on the edges of the banks wherever there is a strong Atlantic influence. They are trawled by Russians and Germans in the western Ba-

Barents Sea, by Germans and Icelanders south of Iceland and Greenland, and by Canada and the United States of America on the Newfoundland banks. Recently large stocks have been found south of the Denmark Straits and northeast of the Grand Banks. The fishery has increased considerably in recent years and research is only just beginning. There is confusion about the species and it is unknown whether the population is one large one or, more probably, several separate ones. Although the fish is slow growing, it could probably yield larger catches, especially if it could be fished pelagically in the open ocean.

Traditionally, herrings in European waters have been fished with drift net or ring net when the shoals were near the coast in their spawning or feeding migrations. Herring is an oily fish and will not keep fresh long, and must be brought quickly to market. But in recent years the demand for herrings, not for eating, but for oil and meal, has grown; the fish need not be in such good condition when landed. Consequently, herring trawling and oceanic fishing has increased. In the Atlantic section of the sub-arctic the greatest herring population is found in the Norwegian Sea, and the Norwegians took nearly a million tons of fish from this stock in 1953. There are herrings in the Barents Sea which are exploited by the Russians, who also fish in the north Norwegian Sea with drift nets. The Icelanders fish for herrings all round their coasts and the Canadians off Nova Scotia and in the Gulf of St. Lawrence. In the Pacific there is herring fishing south of Alaska for bait and meal and large fisheries further south. The herring fisheries are seasonal and research is needed into the migration routes of the different populations or races and the reasons for their variation in position and timing from year to year. It used to be thought that stocks were inexhaustible, but this is now being questioned by some North Sea fishermen. However, it seems safe to say that the Norwegian and Barents seas could yield still greater quantities and that these will be taken when new methods of fishing are perfected.

The other chief pelagic fish of the sub-arctic, the capelin, is hardly fished at all. Some are taken for bait in north Norway and some for bait and oil in Newfoundland, but the vast shoals found off Newfoundland, Labrador and Greenland, north of Iceland and at Jan Mayen and in the Barents Sea, are unexploited. It could be used for oil and meal like herring or, if methods of preservation could be found, it could be eaten fresh or canned. It can be recommended as a very tasty fish. It might prove difficult to catch away from its coastal spawning grounds and pelagic trawling would probably be the best method to employ.

One other sub-arctic fishery that should be mentioned is the King Crab fishery of the Bering Sea which is being expanded by the fishermen from the United States of America and Alaska.

IX. Summary

The greatest increase in exploitation of the fisheries resources of the sub-arctic would come from the development of a fishery for capelin; from increased fishing for herring and redfish; and from greater exploitation of various stocks in the Bering Sea. Some increase may come from cod and haddock, if their living area continues to expand. The increase from the pelagic fish would require improved methods of fishing and processing.

It seems unlikely that man will overexploit the riches of the sub-arctic seas, but he may upset the balance of nature. When he took too many whales, perhaps he allowed more cod to live on the krill; if he takes too many cod, perhaps more herring and capelin will survive; and by the time he takes too many pelagic fish, perhaps he will have found a way of using directly the great production of zooplankton.

BIBLIOGRAPHY

- (1) BROTSKAJA, V. A., and ZENKEVICH, L. A. Quantitative Evaluation of the Bottom Fauna of the Barents Sea. *Trans. Inst. Mar. Fish. U.S.S.R.*, 4: 5-126.
- (2) CLARKE, G. L. Dynamics of Production in a Marine Area. *Ecol. Monogr.*, 16: 322-35.
- (3) CONSEIL PERMANENT INTERNATIONAL POUR L'EXPLORATION DE LA MER. *Bull. statist. pêch. marit., Copenh.*, 38 (1953).
- INTERNATIONAL COMMISSION FOR THE NORTHWEST ATLANTIC FISHERIES. *Statistical Bulletin*, Halifax, Canada. 3 (1953).
- FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS. 1955 *Yearbook of Fishery Statistics*, FAO, Rome, Italy. 4 (1), 1952-53.
- (4) DEVOLD, F. A Contribution to the Study of the Migrations of the Atlanto-Scandian Herring. *Rapp. Cons. Explor. Mer.*, 131: 103-107.
- (5) DUNBAR, M. J. Resources of Arctic and Sub-arctic Seas. *Trans. roy. Soc. Can.*, 45, Ser. 3, Sect. 5: 61-67.
- . Arctic and Sub-arctic Marine Ecology: Immediate Problems. *Arctic*, 6 (2): 75-90.
- (6) ELLSON, J. G., POWELL, D. E., and HILDEBRAND, H. H. Exploratory Fishing Expedition to the Northern Bering Sea. *Fish. Leaf.*, Wash., No. 369.
- (7) HARVEY, H. W. On the Production of Living Matter in the Sea off Plymouth. *J. Mar. biol. Ass. U. K.*, 29: 97-137.
- (8) KOCH, L. The East Greenland Ice. *Medd. Grønland*, 130 (3). 1945
- (9) LEE, A. J. The Influence of Hydrography on the Bear Island Cod Fishery. *Rapp. Cons. Explor. Mer.*, 131: 74-102.
- (10) RASMUSSEN, B. Fiskeriforholdene og Torskebestanden ved Vest-Grønland 1951. *Årsberetning vedkommende Norges Fiskerier* 1951, Bergen, Norway, (5): 121-37.

- (11) SVERDRUP, H. U. Some Aspects of the Primary Productivity of 1952 the Sea. *FAO Fisheries Bulletin*, FAO, Rome, Italy, 5 (6): 215-23.
- (12) TÄNING, Å. V. Long Term Changes in Hydrography and Fluctuations in Fish Stocks. *Annual Proceedings, International Commission for the Northwest Atlantic Fisheries*, Halifax, N. S., Canada, 3: 69-77.
- (13) THOMPSON, H. A Biological and Economic Study of Cod (*Gadus callarias*, L.) in the Newfoundland Area. *Res. Bull. Div. Fish. Resour. Newfoundld.*, No. 14.
- (14) UNITED NATIONS. *Proceedings of the United Nations Scientific Conference on the Conservation and Utilization of Resources*, 1951 1949. U. N. Department of Economic Affairs, New York. 7 (Wildlife and Fish Resources).
- (15) WEBSTER, C. J. The Soviet Expedition to the Central Arctic, 1954 1954. *Arctic*, 7 (2): 59-80.
- (16) WIBORG, K. F. Zooplankton in Relation to Hydrography in the 1955 Norwegian Sea. *Rep. Norweg. Fish. Invest.*, 11 (4).

THE FISHERIES OF ANTARCTICA*

Introduction

A few tons of fish are taken each year off South Georgia (lat. 54° 30' S., long. 37° W.) for local consumption by whalers and sealers at the shore establishments there. But no attempt has yet been made to set up a substantial fishery anywhere in the colder, more southerly, waters of the southern oceans. At first sight this apparent neglect of the piscine resources of the vast Southern Ocean may seem surprising. Antarctic and sub-antarctic waters have long been recognized to teem with life and, indeed, for half a century, have supported by far the greatest whaling industry the world has ever known. A little reflection, however, will readily suggest some of the difficulties involved in establishing a piscine fishery of importance. The pelagic whaling industry depends upon the capture each southern summer of some tens of thousands of whales which have, most conveniently, already concentrated the organic matter of the ocean into valuable parcels of over 100 tons each. The capital involved in this industry is enormous, while its period of operation each year is limited to less than three months. The activity of the industry is controlled by the International Whaling Convention. In contrast, the problems which face any future exploitation of fishes in the Southern Ocean are severe indeed.

*By G.C.L. Bertram, M.A., Ph.D., Director of the Scott Polar Research Institute, Cambridge, England, and J.D.M. Blyth, M.A., formerly Editor of the *Polar Record*.

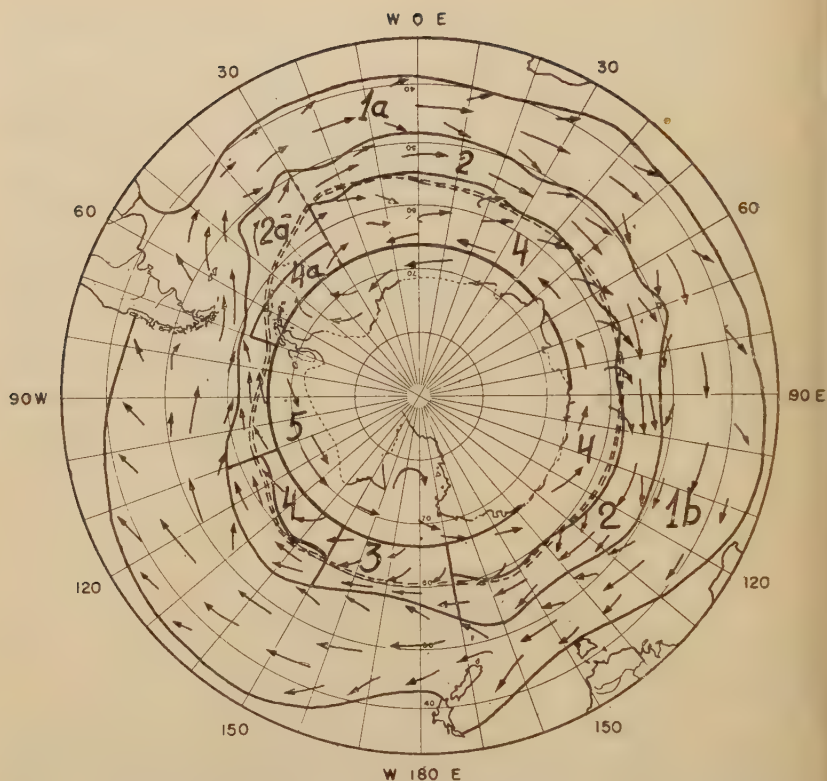


Figure 3. Natural regions of the Antarctic with indication of the currents (compiled from various sources by the FAO Fisheries Biology Branch)

- Boundaries of the regions ;
- ==== Average "winter" ice boundary ;
- Surface currents.

Sub-Antarctic Region

- 1 West-wind Drift Region ; 1a Atlantic ; 1b Indo-Pacific.

Antarctic Region

- 2 Northern Region. 2a Scotia Sea waters. 3. Area north of the Ross Sea. 4. Intermediate Region. 4a Wedell Sea. 5. Southern Region.

I. Difficulties

Concentrations of fish adequate to form the basis of important fisheries usually occur in the relatively shallow waters bordering extensive coasts. The continental shelves, waters extending out to the 100-fathom line, are normally those first exploited. But continental Antarctica is peculiar in the narrow extent of its surrounding shelves. Along some sections of the coastline there is

no shelf in the normal sense, depths dropping at once to over 200 fathoms. In other sections the shelf is no more than 30 miles wide (48 km.). The greatest known width is 300 miles (480 km.), but this is, of course, exceptional.

Another difficulty, so well-known as to require no emphasis, is the extraordinarily harsh climate of the Southern Ocean which is characterized by violent winds, storm-swept seas, and low temperatures. In addition, pack-ice and icebergs present a constant menace to navigation; in the vicinity of the continent itself and, during the long winter months, the sea ice extends many hundreds of miles to the north. These are grave handicaps to the establishment of a fishing industry, but there are other drawbacks too. The great distances between potential antarctic fishing grounds and the nearest markets and centers of population must be considered, together with the associated problems of preservation and delivery of catches and the maintenance of vessels. Australia lies some 1,800 geographic miles (2,900 km.) from the nearest part of the antarctic continent. South Africa 2,100 miles, (3,380 km.) and New Zealand 1,400 miles, (2,250 km.). Although the southern tip of South America lies no more than 700 miles (1,130 km.) from the northern extremity of the Graham Land peninsula, the nearest potential markets in Argentina and elsewhere are many hundreds of miles farther north. Indeed, but a very small proportion of the world's total population inhabits the southern hemisphere. The difficulties of developing any substantial piscine fishery in antarctic waters at present are obviously overwhelming. Before anything important is done the stimulus must be much greater than it is today.

II. *The Antarctic Zone*

What then, are the possible attractions of an antarctic fishery? Ichthyologists have found it convenient to distinguish two distinct zones in the Southern Ocean. The first of these, lying immediately around the continent itself, is known as the Antarctic Zone. Its northern limit corresponds to what is generally known as the antarctic convergence, where cold antarctic water meets and sinks sharply below warmer sub-antarctic water. This convergence corresponds fairly closely to the mean annual surface isotherm of 43° F. (6° C.). The Antarctic Zone is sub-divided into two distinct areas, known as the Glacial District, which comprises the antarctic continent, South Georgia, the South Shetland Islands, South Orkney Islands, South Sandwich Islands and Bouvet Øya, all within the northern limit of the pack-ice, and the Kerguelen District, comprising Macquarie Island, the Îles de Kerguelen, Heard Island, Îles Crozet and the Prince Edward Islands. The first specimens of fish to be taken in the Antarctic Zone were brought back by the British naval expedition of 1839-1842, com-

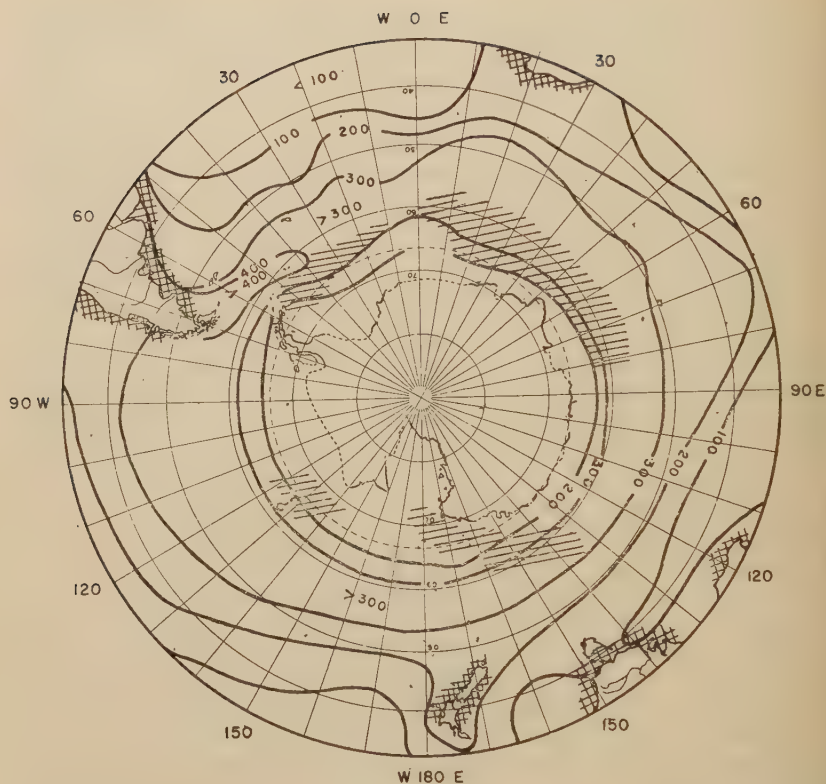


Figure 4. Estimation of standing crop of zooplankton biomass (mg/m^3) in upper 300 m. and the possible fishing and whaling areas (compiled by FAO Fisheries Biology Branch)

⊞ fishing areas

≡ whaling areas

manded by Sir James Clark Ross. Since that time some 86 species have been reported. Nearly all the genera and species are peculiar to far southern waters and nearly all belong to a single group, the *Nototheniiformes*, which is characteristic of, and almost restricted to, the Southern Ocean. The comparatively limited number of species in no way implies scarcity of fish, but rather the reverse. Nevertheless, as already mentioned, no important attempt has yet been made to exploit, or even to explore, the potentialities which undoubtedly exist. The fish taken at South Georgia belong to several small cod-like species of *Notothenia*, about 1 ft. long, known locally as "torsk." These fish are readily taken on a jig line without bait. Another edible species, known locally as "crocodile fish," (probably *Parachaenichthys georgianus*) is also taken off South Georgia. Some 20 to 30 miles (32 to 48 km.) offshore, extensive shoals of a larger and more palatable species of "cod," *Notothenia*

rossi, have been reported. This species grows to a length of about 2 ft. (60 cms.) and individual specimens often weigh up to about 20 lb. (9 kg.) each. They are known to feed upon the same plankton as whales, and it is possible that they are much more abundant in the Southern Ocean than has been realized.

III. The Sub-antarctic Zone

The second zone in the Southern Ocean is known as the Sub-antarctic Zone. This lies between the antarctic convergence and the sub-tropical convergence, which corresponds fairly closely to the mean annual surface isotherm of 54° F. (12° C.). In some areas, particularly along the shores of South America, the sub-tropical convergence extends far to the north of the Southern Ocean, and therefore falls outside the scope of the present enquiry. A limited amount of exploitation of the demersal fish resources has been undertaken in this zone, particularly in the waters of the Patagonian continental shelf, lying west and northwest of the Falkland Islands. Investigations were made by the *Discovery* Committee between 1927 and 1932 with a view to the possibility of establishing a trawling industry at Port Stanley, the capital of the British colony of the Falkland Islands. The relatively shallow waters of the Patagonian continental shelf, covering an area of some 150,000 sq. mi., (388,500 km²) have an average depth of between 20 and 100 fathoms, with a sandy bottom. Edible fish were moderately plentiful, the most promising species for human consumption being hake (*Merluccius hubbsi* and *Macruronus magellanicus*) and, of lesser importance, spotted pomfret (*Stromateus maculatus*). Although sponge, coral, and huge brown algae present some hindrance, it is believed that this would be overcome with constant trawling. Despite the favorable report of the *Discovery* Committee, no attempt has actually been made to establish a trawling industry at Port Stanley, probably because it remains doubtful whether smoked, dried, dehydrated or frozen fish could be marketed at an economic price in the Argentine markets far to the north. There is still less information on the prospects of commercial fishing in these waters by means other than trawling.

Investigations were likewise made around the indented coastline of the Falkland Islands, and on the Burdwood Bank, another area of shallow water covering some 300 sq. mi. (777 km²) to the south of the islands. "Mullet" (*Eleginops maclovinus*), "smelts" (*Austromenidia smitti* and *A. nigricans*), and "herring" (*Clupea fuegensis*) were found in considerable numbers around the Falkland Islands, and an edible crab (*Lithodes antarcticus*) proved to be plentiful on the Burdwood Bank. Both these grounds are rough and, being rich in coralline growths, are unsuitable for trawling. Nevertheless, a small inshore fishery might well be developed in the Falkland Islands.

IV. The Future

It is evident that the prospects for the establishment of any antarctic piscine fishery are far from encouraging. Seal and whale fisheries have long existed and, with conservative operation, should continue. Yet surely, the waters of the Southern Ocean, with their great abundance of plant and animal life — which may properly be presumed, even if not fully demonstrated — must eventually contribute their fair proportion to the food requirements of mankind. The stimulus may be great; world population is likely to increase by a thousand million in the next generation. At present, man captures the whales and the seals, the topmost members of the food chains. The fish, the middle members of the food chains, may perhaps, in this instance, never be the most economical for capture. If prophesy may be ventured, it will be the larger planktonic crustacea which will be subject to direct exploitation. This crustacean plankton, the “krill” of the whalers, mostly *Euphausia superba*, an organism which grows to a length of about $1\frac{1}{4}$ in. (3 cm.), is present in the Southern Ocean in enormous abundance. It is rich in oil and is the foodstuff of the whales. Much work has been done by the *Discovery* investigations on the growth, distribution and abundance of the *Euphausia* spp. Areas of especial local abundance are known both to man and to the whales; one such area near South Georgia is a good example, and is clear of sea ice. It is not beyond the bounds of possibility to conceive of floating plant, anchored in deep water, powered by the ever-blowing westerly winds, uninhabited and automatic, and visited at intervals of months for the removal of the crustacean sludge extracted by mechanical separation. Such development would seem more promising than direct fishery in antarctic waters.

SELECTED REFERENCES

- ‘DISCOVERY’ COMMITTEE. *Report on the Progress of the ‘Discovery’ Committee’s Investigations*. London. pp. 31-39.
1937
HART, T. JOHN. Report on Trawling Surveys on the Patagonian Continental Shelf. ‘*Discovery*’ Rep., 23 : 223-408.
1946
MATTHEWS, L. HARRISON. *South Georgia, the British Empire’s Sub-antarctic Outpost: a Synopsis of the History of the Island*. John Wright, Bristol, England; Simpkin Marshall, London. pp. 35-36.
1931
NORMAN, J. R. Coast Fishes. Part 3. The Antarctic Zone. ‘*Discovery*’ Rep., 18 : 1-105.
1937
OLSEN, STEINAR. Syd Georgia-torsken (*Notothenia rossii marmorata* Fischer). *Norsk Hvalfangsttid.*, 43 (7) : 373-82.
1954

PROBLEMS OF FISH MARKETING IN THE INDO-PACIFIC REGION *

Reprinted from the Report on the First FAO-ETAP International Fish Marketing Training Centre, Hong Kong, 11 July - 31 August 1954, pp. 26-30. In the course of their studies, the participants prepared surveys on fish marketing in their own countries. (The survey referred to in this article represents their collective work).

1. Production and Transportation Problems

The survey reveals a number of problems which, in spite of the great heterogeneity of the countries of the Indo-Pacific Region, are common to most of them and therefore call for similar policy measures. It is almost invariably stated that, after rice — the staple food of the Region's population — fish is, or should become, the main item in the diet. Due to the generally under-nourished condition of the population in the Indo-Pacific countries, increasing the consumption of fish is usually regarded as a major national problem. Its solution, in general terms, requires an increase in the output of aquatic products, improvement in the methods of fish processing and preservation, an efficient system of transportation and marketing, and stimulation of the demand for fish and other fisheries products.

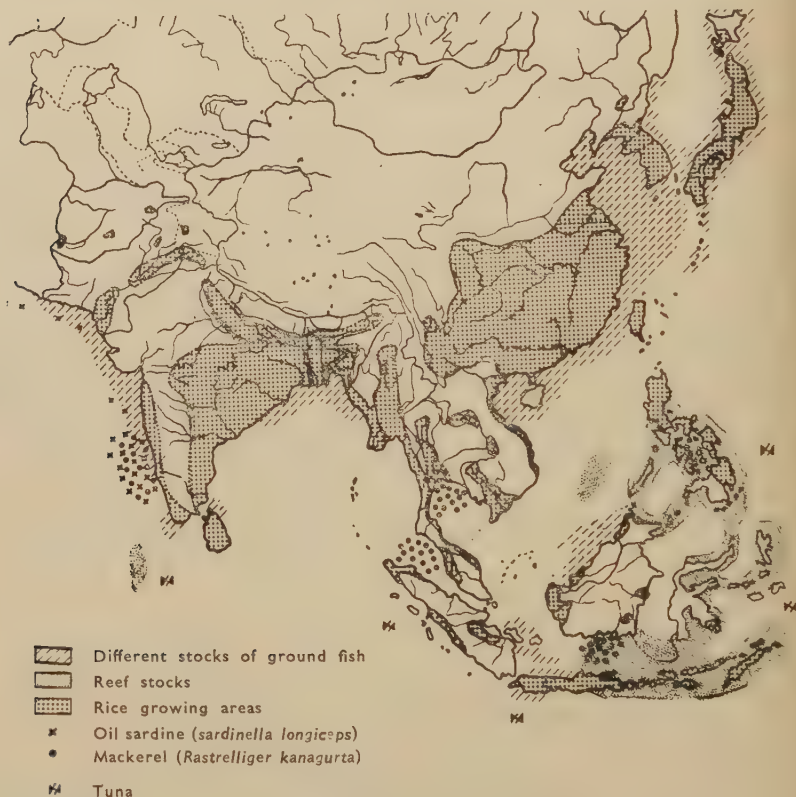
The survey indicates that the existing fisheries resources in the Region are seldom fully exploited. Coastal fishing is normally best developed. Deep sea fishing in the Arabian Sea, the Indian Ocean, the Bay of Bengal, the Gulf of Thailand, the South China Sea and in the vast Pacific Ocean is still very limited. The same usually applies to inland fisheries. Many of the fisheries resources of the great rivers of the Region, such as the Indus, Ganges or Irrawaddy, have hardly been touched, and the vessels, gears and techniques employed are seldom the most appropriate ones. Generally speaking, the problem calls for the more efficient management and conduct of marine and inland fisheries operations, including the introduction of better equipment and the teaching of superior techniques. In this respect the achievements in Japan afford a sharp contrast to development in other countries of the Region.

Clearly connected with the above problems is the question of fishing ports and landing facilities. Again, with the exception of Japan and a few other local instances, the situation is unsatisfactory. Nearly all the participants in the Centre complain that

* By Edward Szczepanik, Lecturer in Economics, University of Hong Kong, Hong Kong.

landing facilities in their own countries simply do not exist. To quote a picturesque description, "the men, carrying their baskets of fish, have to wade, often for long distances, through very soft, loose clay frequently reaching up to the waist and then have to climb up a high bank; having landed one load they then come struggling down again to fetch the next."

CHIEF KNOWN FISHERIES RESOURCES OF SOUTHEAST ASIA



Littoral stocks on all coasts

The hot climate of the Region makes storing, preservation and processing facilities of the utmost importance. In this respect the national surveys seldom express satisfaction. Ice factories and refrigerating plants are a rarity, so that fish storage and preservation, if available at all, is very expensive. The modern fish pro-

processing industry has only very recently started to develop. In view of the difficulties connected with storage and preservation, the processing industry should perhaps receive far greater attention than it does at present ; all the more so because of its potential for creating a number of subsidiary labor absorbing industries. The participants frequently voiced the opinion that governmental initiative in this field would be very desirable.

Transportation presents another bottleneck in the provision of an adequate and cheap supply of fish and fish products in the countries of the Region. Its solution involves a great number of factors, such as the construction and improvement of roads and railways, the provision of insulated trucks and rail cars as well as sea and river vessels, the supply of suitable standardized containers, etc. In this particular field the Hong Kong model is of limited application on account of the proximity of the landing places to the consumption centers in this small colony, for most of the countries of the Region are large. For the insular countries, such as the Philippines and Indonesia the Japanese sea transport organization provides a more satisfactory model. For the remaining countries the future will depend on the development of road, rail and eventually perhaps even air transport. In this connection it should be mentioned that some experience concerning the transport of fish by air has been recently gained in Viet-Nam under the pressure of prolonged war conditions. Governmental intervention in the transport of fish is another point frequently recommended by the participants.

II. Wholesale Fish Marketing

The wholesale fish marketing facilities in most of the countries of the Region are unsatisfactory. To quote again :

Most of the wholesale markets are merely spaces on the sandy beaches where the fish are landed... The market itself consists of a series of sheds with galvanized iron roofing set so close together as to make it appear one single construction... There are no walls nor any kind of enclosures. Beach sand forms the flooring. The containers, full of fish, are placed on the sand in front of each wholesaler, who is surrounded by buyers... and the general public, including the fish pilferers (mostly children). During the stormy weather the surf reaches up to the market and renders it unusable. There are no storage facilities so that the catches have to be sold to the buyers as soon as they are landed. No office rooms, nor sanitary installations are available.

Similar descriptions, with slight modifications, appear in most of the national surveys.

It is commonly maintained by the participants that the system of open public auctions is the best method for selling fish in whole-

sale markets. In most cases this actually takes place, although in certain countries, e. g., the Philippines and Pakistan, there is a system of secret bidding. This practice could possibly be eliminated by suitable legislation. As far as the techniques of wholesale auctions is concerned, they vary greatly from country to country. The survey contains several illustrations of the methods employed, ranging from a rather primitive but apparently efficient system of auctioning used in the Punjab (Pakistan) to a very elaborate system of auctions initiated by the Dutch at the Paser-Ikan market in Djakarta (Indonesia). The system of auctions in Hong Kong is also fully described, and contains a detailed picture of accounting procedure and connected operations.

A complaint raised very often by the participants concerns the high charges levied by the private or public owners of the wholesale markets, e. g., municipal bodies. They frequently recommend that the markets should be run either by public corporations or by the fishermen's co-operative societies themselves. In this respect, the Hong Kong system was of special interest. Even in the case of Japan, it was thought that the revision of the Central Wholesale Market Law should incorporate some similar method of running the markets by a public fish marketing organization.

The survey contains several examples of the legal framework designed by various governments setting up organized fish marketing. Japanese legislation, introduced in 1923, although now obsolete in some respects, provides an interesting distinction between the wholesale markets in producing areas and those in consuming areas. Apart from Hong Kong, central fish marketing organizations have been in existence in Burma and Thailand since 1953. These organizations are closely connected with the fishermen's co-operative movement. As a rule, in other countries of the Region, the participants recommend the introduction of a similar organizational framework. They usually advocate the adoption of pilot schemes first so that the solutions most applicable to the particular local conditions can be ascertained before extending organized marketing system to the whole country.

The authors of the national surveys are almost unanimous in their opinion that the present selling system is detrimental both to the fishermen and to the consumers. Fish merchants are accused of exploitation, monopolistic practices, retardation of technical progress, unhygienic handling of the products, etc. An attempt to defend the "middlemen" or at least to see "the other side" is presented in Chapter VIII dealing with Malaya. It is pointed out there that sometimes the merchant can be exploited by dishonest fishermen, that the accusation of charging exorbitant prices can be proved only by an analysis of the cost and price structure, and that the risks connected with transportation and the inherent instability of supply may often justify the high level of prices. On the other hand, it has to be admitted that many of these risks can be eliminated in a large scale state or co-operative marketing organization

because of the operation of the law of large numbers. This is perhaps a major scientific argument in favor of replacing private fish trading by state or co-operative trading. It should not be forgotten, however, that, as a rule, an essential part of the merchant's activities consists in the provision of capital to fishermen. If the co-operative or state marketing organization cannot undertake this financial activity, there can be no grounds for expecting that such a solution will be complete.

1. *Retail Fish Marketing*

The observations concerning the facilities available in the wholesale fish markets often apply also to retail markets.

As a rule the fish are sold in general markets. These are merely open spaces either covered with a permanent or temporary roofing of reeds, or left uncovered. The floors are of brick, surfaced with a thin layer of plaster. There are no arrangements for cold storage, and only in some cases are there proper facilities for displaying and dissecting the fish. As a general rule, there are no sloping platforms, no water supply, nor facilities for drainage, washing and disinfection. The markets always smell and are infested with flies. Most of the markets are privately owned and there is no practical interference from the Government. Some of the markets... belong to local authorities and stalls are rented to merchants.

It is probably in respect to marketing facilities that most can be done quickly and at not too great a cost, and it is in this sphere that organized state, co-operative or municipal action could bring positive results in the not too distant future, by the provision of more adequate premises suitably equipped and supervised.

In the transactions between retailers and consumers the most common method employed is that of bargaining or negotiation, although there are also numerous instances of adhering to fixed prices ruling for the whole day. As one of the participants reports, "the retailer, normally a woman, squats on the floor with the fish around her. She hides the good quality fish and tries to sell the fish already gone bad first of all. The hours of sale are not fixed and there is no certainty that fish will be obtainable every day."

Generally, the national surveys indicate that profit margins are usually highest in the retail trade. Strangely enough, with the exception of wartime emergency measures, prices in the retail trade are seldom controlled. Apart from maximum-price fixing in some countries, no special institutional measures to deal with this problem are proposed. The contributors to this volume generally propose that the fishermen's co-operative societies should also

gradually take over the retail trade. In some countries a beginning has already been made. There is, however, a danger in this method since it may lead to the complete monopolization of fish marketing by the co-operatives.

If competition among retailers cannot bring down profit margins to a reasonable level, the following remedies are suggested: either to promote consumers' co-operatives, or to introduce government-owned retail shops. The Report does not mention the existence of "fish consumers' co-operatives" in any of the surveyed countries. Presumably a "fish consumers' interest" is seldom realized. It would be reasonable, however, to stimulate consumers' interest and to arouse organized action whenever the fishermen's co-operatives failed to maintain a sufficiently low level of retail prices. In some countries, e.g., Ceylon, it has been suggested that the general consumers' co-operatives should be encouraged to undertake the retail sale of fish. Instances of governmental participation in the retail fish trade for the purpose of lowering prices have been normally limited to periods of wartime emergency.

In any analysis of fish marketing the demand side cannot be neglected. In this connection it is worth mentioning that in many sections of the Region's population, fish is excluded from the diet on religious grounds. A typical case is the Indian State of Sarawak where 92% of the population believe in "Ahimsa" (i.e., non-cruelty to animals.) Again, for religious reasons, scaleless fish, sharks, skates, rays and oysters, are not eaten by the majority of Muslims. These are powerful factors greatly influencing the state of the fishery industry in the Region. It is possible, however, that this attitude will gradually change. Some countries are already trying to introduce specific measures to stimulate the demand for fish. In Pakistan, for instance, certain days have been declared as meatless in order to increase the consumption of fish in the country. In some countries the consumers do not like dried and cured fish. Perhaps with the improvement of existing, and the introduction of new, methods of fish processing, this attitude will be changed too. At the moment, however, probably the most important factor keeping the demand for fish at a generally low level is the unsatisfactory state of fish storing, preservation and handling which severely limits the availability of fish supplies in general and makes many consumers reluctant even to visit fish markets or fish retail shops.

A special problem usually arises in connection with the demand for fish and fish products in rural areas of the Region. The purchasing power of rural populations is normally so low that with the existing methods of preservation, transportation and marketing the prices of fish are beyond the means of this group of consumers. The participants see the remedy for this problem mainly in the extension of the supply of cheap processed fish to farming villages by a specially organized private or co-operative system of distribution.

International Aspects of Fish Marketing

Because of the deficiency of internal demand in many countries of the Region, an export trade in fish and fish products has developed. With the existing methods of fish storing, processing and transportation, the volume of this trade is normally small. From the point of view of the general economic development of the Region this problem deserves serious attention. It appears that so far it has never been tackled systematically on a regional, i. e., international plane. Some of the participants put forward the view that co-operation between national fish marketing organizations might greatly help in this respect. At the moment, individual countries are making efforts to develop exports, hoping in this way to achieve favorable balances to finance projects requiring foreign exchange for the purchase of capital goods. So far, Japan has been the most successful with her export of fisheries products. Indonesia has also great ambitions in this respect but her present position is not yet satisfactory. A secondary aspect of this intra-regional trade in fisheries products consists in the possibility of providing salutary competition to bring down retail prices.

The remarks in the last paragraph bring to light the general problem of intra-regional co-operation in solving various aspects of the Region's fishery industry, and in particular the marketing of its products. From this point of view the Hong Kong Fish Marketing Training Centre has proved a successful venture, since it not only provided an opportunity for studying various solutions employed in different countries of the Region but also stimulated the minds of a large group of people concerned with the well-being of the Indo-Pacific nations. The Report, summarizing the main results of the Centre's work, should be regarded as the next step in the process of regional fish marketing research contributing to, it is hoped, the continuing improvement of this important section of the Region's economic policy.

There is ample proof that the fish marketing policy in many countries of the Region is unsatisfactory simply because so little is known of the position itself. In this connection attention should be drawn to the role of the numerous fishery surveys in the development of the fishing industry and trade in Japan. Chapter VII, dealing with Japan, provides a good example of the extent to which information can and should be collected in order to see clearly the lines for future action. An interesting illustration of the fishery survey technique comes from Viet-Nam, and is briefly described in the last chapter of the Report. Another example of the method of fish marketing surveys is now being worked out in Taiwan (Formosa) by the Joint (Chinese-American) Commission for Rural Reconstruction in co-operation with the Agricultural Economics Department of the College of Agriculture of the National Taiwan University. The experience derived from the fish marketing studies in Taiwan should soon become available to other countries of the

Region. Finally, various western surveys, such as those of Carriada, for instance, provide good examples of this essential work.

So far as actual policy is concerned, the major conclusion emerging from the regional work done in the Hong Kong Centre is that the chief method of improving fish marketing in the Region is via co-operatives. The Report provides numerous references to the improvement which is claimed to have followed the development of fishermen's co-operative societies. The Hong Kong model itself is a very good example of this thesis. Instructive pictures are contained also in the surveys of Burma, Indonesia and Japan. On their return home, several participants submitted to their governments reports in which, having contrasted their own national situation with the position in other countries where the co-operative movement has led to a new phase in the development of the fishery industry, they urged the introduction of similar measures.

In only very few cases, however, would the co-operative movement alone provide a sufficient lever for increased production and better marketing. This Survey gives several examples of the failure of co-operative movements among the fishermen. There is an interesting examination of this phenomenon in the State of Orissa in India. The two main points emerging from this analysis are : (a) that the co-operative movement, at least in its initial stage, requires a "paternal" attitude of the Government, e.g., in Hong Kong or Burma, and (b) that it has little chance of success unless it is combined with appropriate educational measures, as, for instance, in Japan, Indonesia or Burma. Further studies of this problem deserve consideration and it is hoped that they will be encouraged by the national and international bodies concerned.

LEGISLATION FOR THE FISHING INDUSTRY OF THE FEDERAL REPUBLIC OF GERMANY *

The fishing industry of the Federal Republic of Germany is subject to legislation by two bodies : the Federal Legislature, and the legislature of the Federal Länder. The Federal Government has pre-eminence in making laws, and will always have pre-eminence in view of the inter-territorial nature of the fishing industry. The Länder may legislate only in default of federal legislation and their laws will therefore be of local significance only. This arrangement is founded on the Basic Law (the *Grundgesetz*) of the Federal Republic of Germany.

In addition to the laws issued by these two bodies, some of the laws of the former German Reich and the Länder of the Reich are still in force ; in particular, the Prussian Fishery Law.

* By Dr. H. G. Küttner, Bundesministerium für Ernährung Landwirtschaft und Forsten, Bonn, Western Germany.

The legislation of the Federal Government is concerned with :

(a) the regulation of national fisheries problems of the Federal Republic ;

(b) international problems.

Among the laws recently enacted, special mention should be made of the *Fishery Law on Handling and Marketing Fish and Fish Products*. This law, one of a series of agricultural marketing laws, was difficult to devise as it had to be in keeping with the principle of "freedom of marketing," which is part of the economic structure of the Federal Republic. It had especially to avoid any control of marketing.

Opinions vary on the value of the Law, which is so devised as to provide an opportunity to intervene in the interest of orderly marketing without using compulsory action. The Law does not, of course, seek to reorganize the whole structure of marketing within the fishing industry, for that is largely determined by the natural laws. It seeks to encourage steady supplies, stable prices and better quality fish and fish products. The most important sections are given below.

Section 1 defines the terms and emphasises that the Law does not refer to German inland water fisheries.

Section 2 calls for the federal Minister of Food and Agriculture to prepare a supply scheme for each economic year, which corresponds to the calendar year. Based on experience gained in previous years, the Minister estimates the quantities of fish likely to be available from home landings, and the quantities which have to be imported to cover his estimate of requirements for the home market. In making these estimates the Minister must consult the authorities of the coastal Länder and must receive the comments of the representative organization of the German fish industry, the recently established Federal Market Association (*Bundesmarktverband*).

The same section enables producers and first buyers to enter into contracts for delivery and purchase of fish covering a whole fishing season. Hitherto, fish in the Federal Republic has been sold exclusively by auction. There are certain disadvantages inherent in this method of sale. For example, the fish landed from the first trawler may be of inferior quality yet may frequently reach better prices than good quality fish landed later when supplies are heavier. This situation does not encourage fishermen to consider the quality of the fish they catch nor to maintain high standards in handling the fish on board. Again, when fish are auctioned it often has to be kept many hours before sale, sometimes at high temperatures and without ice, so that the quality of the catch deteriorates considerably. Auctioning is unnecessary under the new law as fish may be supplied by producers direct to one or several customers. Such contracts between producers and wholesalers will encourage the trawler owners to land good quality fish and will develop confidence in all sections of the trade. It is also felt that selling fish by con-

tract will help to regulate the supply to the market and maintain steady prices as well as improve the general quality of the produce.

The most important regulation of the Law is found in Section 3. This concerns payment of support prices to trawler owners as part of the mechanism to prevent fluctuating prices and to maintain a stable situation in the fishing industry generally, as well as to improve the quality of fish supplied to the market. Support prices are to be paid when fish suitable for human consumption cannot be sold at minimum prices. Such fish is processed into fish meal. The funds needed for the payment of support prices are raised from the trawler owners who contribute up to DM. 2 per 100 kg. (220 lb.) of fish and fish products. Minimum prices are fixed by the federal Minister of Food in co-operation with the federal Minister of Economic Affairs. The minimum is the lowest price at which fish and fish products for human consumption may be sold. An important point is that the minimum shall be below the cost of production, so that a sale at the minimum price results in a loss! This arrangement has been made to discourage that practice of bulk fishing disregarding the quality of the fish caught and landed. The trawler owner is entitled to receive from the price support fund the difference between the minimum and the price actually received for the fish delivered to the fish meal factory.

The price support payments are of benefit to all branches of the fish industry and not only to the trawler owners, as they encourage stable supplies and stable prices.

Under Section 3, the federal Minister of Food can make the payment of support prices subject to certain conditions which can be used to regulate the marketing of fish. For example, the Minister can decide that no support prices shall be paid for certain species of fish or for fish below a certain size or in a certain condition, or if the fish constitute more than a certain quantity of the landings. If, for instance, there are abundant landings of redfish and the Minister rules that the support price is not to be paid for small redfish, it does not pay the trawler owner to land such fish and he is thus induced to go to other fishing grounds to catch a better assortment of fish. This action is an example of how the new law eases the market situation and leads to a more uniform supply of fish and better balanced prices.

Sections 4 and 5 are concerned with the collection of contributions and the use of the funds.

Section 6 authorizes the federal Minister of Food to raise contributions for the promotion of fish marketing. These contributions are collected from trawler owners, wholesalers and importers at a rate not exceeding DM. 0.20 per 100 kg. of fish and fish products.

The fund is to be used to finance a comprehensive propaganda campaign, to establish new fish shops and to develop a cold chain. Part of this effort to increase the distribution and sale of fish will be concentrated on localities that have less than 10,000 inhabitants. These are centers where there is not enough trade for a fish retailer

to operate profitably, so that substantial increases in the sale of fish must be promoted through the general retail food trade. In addition to funds raised under this Section, credits under federal guarantee and at low rates of interest will be available to promote increased consumption of fish.

Section 7 deals with the functions of the Federal Market Association as an organization representing the fish industry generally. One of the difficulties arising from the heterogeneous character of the fish industry is that no one organization has existed to represent all the various interests concerned. The Federal Market Association was established on a voluntary basis as an organization which could speak for the fish industry concerning basic problems. Under German law no market association can be entrusted with functions which are subject to public law and the statutory functions of the Association are, therefore, limited by law to other than state functions. For example, the Association may function to promote fish marketing, the quality of the product, the study of the market, market reports and statistics and so on. In particular, the Association will advise the federal Minister on basic questions of fisheries policy.

Another important clause, in Section 8, requires the federal Minister of Food and the federal Minister of the Interior to make joint regulations aimed at increasing production, quality and marketing of fisheries products, and to establish minimum standards for the quality of fish and fish products. Such regulations may be concerned with handling and processing, place and duration of storage, and transport of fish and fish products, as well as with the condition and equipment of rooms, containers and facilities for storing and transporting fish. In actual practice, it is still doubtful whether minimum quality standards for fish and fish products can be established as there is yet no objective method of testing the freshness of fish.

This clause in Section 8, concerning the quality of fish and fish products, was included because experience has shown that it is impossible to achieve an improved quality in fish and fish products by means of the existing merchandise grading law (*Handelsklassengesetz*). There are no means of telling by objective testing the degree of freshness in wet fish, and even if it were possible to grade such fish by quality and to define exactly the characteristics of each grade, the quick deterioration of the fish would militate against use of such grades in practical trade. Again, in the processing of fish products, grading can only be applied to the type of ingredients and, perhaps, the processing method and the size and type of the can. A very detailed legal classification of numerous products and types would be required to make this effective and such regulations would scarcely be recommendable from a legislative point of view. Furthermore, they would impose restrictions on producers of fish products, unjustifiable in a free market economy.

To cope with this problem of regulating the quality and freshness of fish, the Federal Government has in mind the revision of existing sanitary regulations. This may be done by means of a fish inspection law (*Fischbeschaugesetz*) which would increase control over fish and extend fish inspection from the landing of fish up to its absorption by the processing plants.

Section 10 deals with regulations concerning reports to be made by the fish industry for use in preparation of market analyses. Laws already exist concerning fisheries statistics and these have worked satisfactorily so far as landing statistics are concerned. But up to the present there has been no information available for the preparation of market analyses. The present Section will help to fill this gap.

During the debate on the new fishery law, it was generally agreed that it will not, by itself, lead to a substantial improvement of the situation in the fish industry because it does not include compulsory measures. What the Law does do is to provide ways and means for the fish industry to act, so as to bring about the orderly development of the marketing of fish in Germany. Even so, it will still need several years of work to achieve the objectives of the new law: more regular, market supplies, smaller price fluctuations and better quality of fish and fish products.

INTERNATIONAL TRAINING CENTRE IN INLAND FISHERIES AND FISH CULTURE, INDONESIA

The International Training Centre in Inland Fisheries and Fish Culture organized by FAO, which opened in Bogor, Indonesia, on 31 October 1955, closed on 10 December after a highly successful series of lectures, prepared by a group of selected inland fisheries specialists. Mr. H. Saanin (Indonesia), Chief of the Inland Fisheries Laboratory, Bogor, acted as director, and Mr. W.H. Schuster (Netherlands), FAO expert, as co-director.

All 20 participants were officers carrying important responsibilities in their own countries, and came from 11 countries and territories — Australia, Burma, Ceylon, India, Indonesia, Pakistan, Philippines, Thailand, British North Borneo, Hong Kong, Sarawak. They returned home with a thorough knowledge of many pond culture techniques, as demonstrated in East, West and Central Java. The lecturers formed a study group to discuss some problems on development of tropical inland fisheries. The complete set of 58 lectures was mimeographed and distributed, and forms a comprehensive work of high value on tropical inland fisheries and fish culture. A report on the courses offered at the Centre is in preparation.

Conferences and Meetings

Meeting of Inland Fisheries Advisers

The need for international action in inland fisheries was the subject of a meeting convened in Rome by the FAO Fisheries Division on 12 and 13 December 1955. Participants included the following advisers: Dr. Gunnar Alm, Sweden; Professor Umberto D'Ancona, Italy; Dr. B. Havinga, the Netherlands; Prof. H. Järnfeldt, Finland; Ing. J. A. Mussard, UNESCO; and Prof. F. Ruttner, Austria.

It was generally agreed that there was need to improve and develop international collaboration in connection with inland fisheries, especially in order:

- (a) to secure the greatest efficiency in the use of research potential in describing the resources, and in formulating and implementing programs for the development of the exploitation of these resources;
- (b) to effect the most efficient management of the resource and, where these resources are shared, to integrate the management programs as far as possible and desirable.

It was the unanimous opinion of the advisers that it would be desirable to convene a meeting of inland fisheries workers at Helsinki in July 1956, immediately preceding the 13th International Limnological Congress, to review the general field of inland fisheries science, and to discuss the need for, and the methods whereby, a firmer collaboration of inland fisheries workers could be established on an international basis — with particular reference to Northern and Central Europe.

This International Inland Fisheries Meeting will take place from 24 to 26 July 1956.

EECE Working Group on Standardization of Perishable Foodstuffs

Under the auspices of the Economic Commission for Europe (ECE) Working Group on Standardization of Perishable Foodstuffs, a group of experts met on 16, 17 and 18 January 1956 in Geneva, to discuss draft recommendations concerning commercial standardization and quality control of salted herring. The experts represented Czechoslovakia, Denmark, the Netherlands, Norway, the United Kingdom, the U.S.S.R., and Western Germany. The U.S.A. and FAO were represented by observers. Dr. D.J. van Dijk (Netherlands) acted as rapporteur, and FAO provided the Secretariat.

The draft recommendations concerning Definition of Product, Packaging and Packaging Materials, Marking, Official Control in

Exporting Countries, were discussed in detail and revised accordingly to make them acceptable to both exporting and importing countries. The meeting adjourned to continue the discussion on the remaining draft recommendations from 5 to 9 November 1956.

The same group of experts met again on 18 January to discuss the Revised Draft Recommendations concerning the commercial standardization and quality control of fresh fish. Dr. E. Hess, FAO, acting as rapporteur, reported on the work previously carried out by the team by correspondence, which had led to the revised draft now presented for discussion. A final revision of the draft recommendations was agreed upon. This will be presented to the next meeting of the Working Group on Standardization of Perishable Foodstuffs, September 1956, for adoption.

2nd FAO Consultants Meeting on Documentation and Related Services for Fisheries Biology*

A second meeting of consultants to consider the subject of documentation and related services for fisheries biology was convened by the FAO Fisheries Division in the Centre d'études et de recherches scientifiques, Biarritz, France, from 25 to 29 February 1956.

The meeting was attended by :

Consultants

Chairman	L.A. Walford	Chief, Branch of Fishery Biology, Fish and Wildlife Service, Washington D.C., U.S.A.
Rapporteur	H.W. Graham	Chief, North Atlantic Fish Investigations, Fish and Wildlife Service, Woods Hole, Mass., U.S.A.
	J. Ancellin	Chef du Laboratoire de l'Institut scientifique des pêches maritimes, Boulogne-sur-Mer, France.
	G. Bini	Editor, <i>Bibliographia Oceanographica</i> , Rome, Italy.
	A. Fredriksson	General Secretary, ICES, Copenhagen, Denmark.
	E.D. Le Cren	Freshwater Biological Association, Ambleside, England.
	C.E. Lucas	Director, Marine Laboratory, Scottish Home Department, Aberdeen, Scotland.

* For a report of the first meeting, see *FAO Fisheries Bulletin VIII* (2): 91-94.

Consultants (continued)

B.B. Parrish	Marine Laboratory, Scottish Home Department, Aberdeen, Scotland.
E.M. Poulsen	Executive Secretary, ICNAF, Halifax, N.S., Canada.
G. Rollefson	Director, Institute of Marine Research, Directorate of Fisheries, Bergen, Norway.
C. Taylor	Fish and Wildlife Service, Woods Hole, Mass., U.S.A.

Observers

L. Barriety	Directeur, Musée de la Mer, Biarritz, France.
L. Boerema	Fisheries Directorate, The Hague, Netherlands.
J. Clark	Fish and Wildlife Service, Woods Hole, Mass., U.S.A.
J.A. Mussard	UNESCO, Department of Natural Sciences, Paris.
G. de la Tourasse	Assistant du Laboratoire de l'Institut scientifique et technique des pêches maritimes, Biarritz, France.
G. Saetersdal	Institute of Marine Research, Directorate of Fisheries, Bergen, Norway.

Dr. G.L. Kesteven and Mr. S.J. Holt, Biology Branch, Fisheries Division, represented FAO.

The consultants had among them the conveners of the various working parties of the ICNAF Research and Statistics Committee (*see* p. 100). As a basis for discussion of the first agenda item, "Classification, Coding and Documentation Techniques," the group considered a draft of a "Decimal Classification for Fisheries" provided by FAO, and agreed that such a classification is urgently required

to bring system and order to a new science which is in critical need of standardization of its terms and their definitions.

After a detailed study of the sections of the classification specially interesting to fisheries biologists, the group offered certain suggestions for improvement in arrangement, use of terms, and general balance in the sub-divisions, and asked FAO to prepare a revised working version.

A request was made also for the Organization to produce a dictionary and a multilingual glossary of terms used in fisheries science, and to circulate it in draft form among specialists in various

countries in which research is being conducted. Finally, the group expressed a belief:

that a card index of world fishery literature, classified by subject and made available to libraries and research workers, would be of inestimable value in the development of the sciences of fishery biology.

Regarding the second item on the agenda, "Bibliographic Science," the group discussed the various types of bibliographic service which might be performed for the benefit of fisheries scientists. It

recognized the excellent work that is already being carried out by FAO in producing *World Fisheries Abstracts*, and annotated bibliographic lists, as requested.

The group considered whether bibliographic services should be expanded to include abstracting and reviewing. It believed that an abstracting service would be of very great value but, recognizing present limitations, recommended

that for the present, emphasis be given to development of services for listing and annotating fisheries literature.

The consultants agreed that:

bibliographic punched cards provide a rapid method of sorting out any kind of group of reference that might be desired, and were of the opinion that if such cards were available there would be a demand for them on the part of research workers.

International Commission for the Northwest Atlantic Fisheries, Standing Committee on Research and Statistics

A special meeting of the Standing Committee on Research and Statistics (ICNAF) was convened in the Centre d'études et de recherches scientifiques, Biarritz, France, from 1 to 10 March 1956. This was the first time that the Commission had organized a meeting in Europe, and it presented an exceptional opportunity for North American and European research workers to meet and discuss common problems. There were representatives from Canada, Denmark, France, Western Germany, Iceland, the Netherlands, Norway, Portugal, Spain, the United Kingdom and the U.S.A., and from FAO and the International Council for the Exploration of the Sea (ICES). The meeting was mostly occupied by a series of working parties discussing:

1. The problem of sampling oceanic stocks that are partly pelagic and partly demersal.
2. A study of the catches of the salt fish fleet.
3. Means of reducing the time required to obtain the necessary data on the dynamics of fish populations.*

4. Arrangements for making the best use of available scientific talent.
5. Assessment of the effects of mesh regulations existing in Sub Area 5.
6. Methods of measuring nets, determining age of fish, and other questions of technique.
7. Laval drift and the differentiation of stocks.
8. Planning a symposium on cod, to be held in conjunction with the 1956 annual meeting of the commission.
9. Symposium on atlantic halibut.

Many of the contributions had been circulated in advance, and there was lively and constructive discussion on each subject. In the final sessions, the reports of the working parties containing recommendations for co-operative research programs in the Commission area were submitted to the whole Committee, which will present an integrated program to the Commission when it meets in Halifax in June 1956. It is hoped that the Commission will publish these reports, which together represent a most important achievement in international collaboration for studying the seas' living resources.

Calendar of Meetings 1956-1957 - Addendum

June/July

FAO International Gear Congress and
Fishery Biology Congress

Venue not
determined

Fisheries Division Activities

Headquarters

A meeting of inland fisheries workers will be held in Helsinki, Finland, in July 1956. This action is being taken on the advice of a group of inland fisheries consultants, who met in Rome with officers of the Fisheries Division, 12-13 December 1955 (*see p. 97*).

Dr. E. Hess, Chief, Technology Branch, visited the Netherlands during December 1955, to discuss arrangements for a meeting of fisheries technologists, to be held in Rotterdam and Ymuiden in late spring 1956. The meeting is to take place under the auspices of the FAO Interim Committee on Fish Handling and Processing.

The 2nd FAO Consultants' Meeting on Documentation and Related Services for Fisheries Biology, took place in Biarritz, France, 25 February 1956.

Mr. F.E. Popper, Chief, Economics and Statistics Branch, left on 4 February 1956 on a visit to the Far East, where he attended the 12th Session of Economic Commission for Asia and the Far East (ECAFE) at Bangalore, India, and, in Tokyo, the Regional Conference of Representatives of the International Commission of UNESCO in Asia.

Personnel

Mr. Kaare Ruud (Norway) joined the Economics and Statistics Branch of the Fisheries Division on 16 February 1956 as fisheries economist.

Mr. Ruud is a graduate in economics of the University of Oslo. From 1952 until 1954 he worked as economist in the Statistics and Economics Branch of the Directorate of Fisheries, Bergen. Since 1954 he has been employed in the Statistics and Economics Branch of the Directorate of Labor, Oslo.

Consultants

Mr. Mario Ruivo of the Instituto Biologia Marítima, Cais do Sodré, Lisbon, Portugal, was engaged as consultant to the Biology Branch, Headquarters, for three weeks during November/December, to work on the preparation of charts and instructions for biological research on sardines. This work was done at the request of the General Fisheries Council for the Mediterranean and as part of the Biology Branch's work on standardization of research methods.

Two consultants were engaged to assist in the preparation of the agenda for the International Fishing Gear Congress to be organized by FAO during the summer of 1957. They were Mr. B. Parrish of the Marine Laboratory, Aberdeen, Scotland, and Dr. A. von Brandt of the Institut für Netz-und-materialforschung, Hamburg.

Regional and Field Work

As the result of requests to FAO from Member Governments for technical assistance, field work is now being undertaken by some 40 fisheries experts in more than a score of different countries. In addition, a considerable number of new requests have been received, and the Division is engaged in recruiting many more experts for the new projects proposed.

Information on recent appointments is given below.

Dr. F. Berger (Austria) arrived in Finland on 10 December to undertake studies on water pollution and to train Finnish scientists in the new chemical techniques. He is carrying out a series of field observations during the winter season, when the effects of pollution on fish and plant life may be critical.

G. Sand (Norway), fish processing technologist, assumed duty in Bangkok, Thailand, on 17 December, 1955, to study methods of fish preservation, with a view to introducing improved practices,

especially in distribution of cold stored, chilled or frozen fish. He will also study methods of quality testing, with a view to the introduction of measures for quality control.

K.K. Rasmussen (Denmark), naval architect, was posted to India in January 1956 to aid Paul Ziener (Norway) in certain sections of his work on the mechanization of local fishingcraft.

Luigi Farina (Italy), fishery engineer, assumed duty in Syria in November on a short-term assignment. This was as a follow-up of the reconnaissance survey made by Dr. W.C. Beckman (U.S.A.), inland fishery biologist, on the marine fisheries off Syria. The main object of Mr. Farina's mission was to demonstrate techniques of fishing with lights for sardines, and the use of an echo sounder to get preliminary indications of the presence of fish.

Projects in marine and inland fisheries biology continue in Burma, Costa Rica, Panama, Guatemala, Honduras, Iraq, Syria, Turkey and Yugoslavia.

W.E. Ripley (U.S.A.), marine fishery biologist, has completed his assignment in Brazil and prepared his report. He has outlined a plan for the organization of fishery biological research in Brazil; he initiated, with Brazilian co-workers, a program of assessment of available marine fish resources; on data collected from various sources, he has prepared a series of maps showing the distribution of dominant species of fish of commercial importance.

This work will be continued and a successor is being recruited.

K.W. Jensen (Norway), inland fishery biologist, completed his mission in Egypt in December 1955 and has prepared his report. Before leaving, he visited Upper Egypt and Lake Karoum, and made a rapid survey of fishing gear and methods, and the indigenous species under exploitation. During his mission, a series of observations was carried out at the disused seaplane base (the Hydrodrome) near Alexandria by a team of Egyptian scientists under his direction. The work will be continued by Egyptian scientists, with the assistance of another expert. The data already gathered will be incorporated by Mr. Jensen into a paper on the productivity of this body of water. A second expert will be assigned to Egypt in 1956 to advise on increasing fish production and management of the natural inland waters in the country.

Projects in fisheries technology continue in Brazil, Ceylon, Chile, Haiti, India, Iran, Iraq, Saudi Arabia, and Turkey.

Carl G. Bjuke (Sweden), fish harbor specialist, returned to Headquarters in December 1955 after a three-months' assignment in India. He and his son, C. Ragnar Bjuke, made a very extensive reconnaissance survey of the requirements of the Government for fish harbor construction and river mouth improvement. Fishing centers and sites, where improvement work might be undertaken, were visited in Bombay State, Saurashtra, Madras (east and west coasts), and Travancore-Cochin. Mr. C. Ragnar Bjuke, during the next few months, will assist the Government in carrying out detailed topographical surveys, soundings and borings at seven

different sites in the States of Bombay and Saurashtra. Contingent on the results of these surveys, plans for engineering works are being developed, some of which will require model tank tests at the Hydraulic Research Station, Poona.

N.P. Hansen (Denmark), fish handling technologist, terminated his assignment in Chile in January 1956 and returned to Headquarters to write his report. During the latter stages of his work, he directed his attention to improving local practices in packing fresh fish on ice, and brining sardines and anchovies for canning.

There have five projects under way in fisheries economics and statistics: Dr. A.A. Dawson (U.K.), fish marketing specialist, is helping the Turkish Government with their appraisal of the marketing facilities of Istanbul, and is making special studies of the price structure and of the possibility of introducing a credit system for fishermen; D. Quiroga Rios (Spain), is assisting the Government of Ecuador in formulating a fishery development program, and is, in particular, helping with advice on marketing and distributing fish and fish products which pass through the fishery pilot project at Manta; a fishery specialist, F.L. Bourgois (France), assumed duty in Libya in January 1956 to carry out a reconnaissance of the fisheries industries and to advise the Government on development plans; a fishery specialist is to be appointed to the Caribbean Commission to advise Member Governments in the area on fishery development, and two statisticians from India to work in Egypt.

There are ten FAO Fellows, three from Israel, two from Yugoslavia, and one each from Chile, Costa Rica, Liberia, Mexico, and Turkey. Newly appointed are: Milton Hugo Lopez (Costa Rica), who will join the team of scientists working under the direction of FAO expert Martin Burkenroad (U.S.A.), shrimp biologist, in Panama; James F. Cooper (Liberia), who will begin his fellowship studies in fishing methods in March, and will visit the U.K., Italy and Denmark, and R. Vega Riva (Mexico), a participant to the Second Latin American Fisheries Training Center, who will study fisheries economics at FAO Headquarters in Rome.

Publications

The FAO Fisheries Division is collecting information on world fishery research and educational institutions. In 1950, an 85-page booklet on fisheries institutions in North and South America, giving details regarding activities, publications and personnel, was published.

The *Directory of Fisheries Institutions - Europe*, has now appeared. For each of the 20 countries covered there is an introduction sheet, describing the general set-up of the fisheries administration; then follow special sheets devoted to each institution. This 198-page Directory is in loose-leaf form, to permit the adding of further information. The introduction sheets for each country are in English, French and Spanish, while the institution sheet is in English only. Available from FAO Headquarters, Rome, Italy.

The Technology Branch has compiled *Lists of A - Manufacturers of Nylon Yarn and Other Artificial Fibers; B - Manufacturers and/or Suppliers of Nets, Nettings and Twines made of Nylon or Other Synthetic Fibers; C - Manufacturers and/or Suppliers of Fishing Lines made of Nylon or Other Synthetic Fiber Materials*. This mimeographed document, later to be supplemented, is available free on request from FAO Headquarters, Rome, Italy.

Notes on Films

HERRING HUNT. Producer and distributor : National Film Board of Canada, Ottawa, Ontario, Canada. Technical data : 16 mm., black and white, sound, 10 minutes. In English. "Canada Carries On" series.

The film shows purse seining herring in British Columbia, Canada; action takes place on the seiner *Western Girl* with skipper and 8 crew; good dialogue. Shows one 900-ton haul.

MEN OF LUNENBURG. Producer : Crawley Films. Distributor : National Film Board of Canada, Ottawa, Ontario, Canada. Technical data : 16 mm., color, sound, 16 minutes. In English and French. Produced in 1947. Price : C\$ 75.00, color; C\$ 30.00 black and white. Rental : C\$ 6.00.

The film shows the hardy sailing folk of Lunenburg, Nova Scotia, their town and homes about the rock-bound harbor, and their ships on the fishing grounds. Long line fishing from dories is illustrated, as well as cleaning, salting and storing the fish aboard the schooners. Boat building scenes in local boat yards are included.

GASPÉ COD FISHERMEN. Producer and distributor : National Film Board of Canada, Ottawa, Ontario, Canada. Technical data : 16 mm., color, sound, 12 minutes, in English, French, Portuguese or Spanish. Produced in 1944. Price : C\$ 30.00 black and white; rental : C\$ 1.50.

For over 200 years, cod has made the lifework, food and livelihood of the small Gaspé village of Grande Rivière. The film shows the catching of herring for bait with gill nets, the baiting of the hooks of the long lines for cod fishing, the hauling of the lines, the gutting and filleting of the fish. The catch is prepared for market in three ways — fresh cod fillets, smoked and dried salted cod. The catch is sold entirely through a fishermen's co-operative. The story is an example of how, through co-operation,

people in a community can build democracy into their way of life.

MEN WHO FISH. Producer: U.S. Army. Distributor: United World Films, Inc., Government Films Dept., 1445 Park Avenue, New York 29. Technical data: 16 mm., black and white, sound, 30 minutes. In English. Made in 1950. Price: U.S.\$43.88.

The film presents a realistic picture of living and working conditions in a typical small Japanese island fishing community. The rigors of the fishing operations and the uncertain rewards attendant on weather conditions and restricted marketing outlets are described. The pernicious effects of old fishing rights which have enabled the lessees to impose heavy levies on the fishermen's earnings, are discussed with reference to recent legislation providing for the transfer of these rights to fishing communities. This should provide greater incentives which, coupled with the growing movement towards self-expression and collective effort among the younger generation, offers hope for higher standards of living among the fishermen and their families.

CUTTING AND PACKAGING BONELESS COD. Producer and distributor: National Film Board of Canada, Ottawa, Ontario, Canada. Technical data: 16 mm., color, silent, 31 minutes. Titles in English or French. Produced in 1949. Price: C\$ 300, color.

An instructional film which demonstrates, in detail, an approved method of finishing boneless codfish. While the film shows how this process is carried out in a large plant, it emphasizes that much the same method may be used on a smaller scale by fishermen in their own sheds. Beginning with the "green" salted cod as they arrive in the fishing boats, the explanatory captions, with illustratory visuals, explain each step in skinning, cutting, boning, drying, trimming, grading and packaging in large and small quantities.

INSIDE STORY. Producer and distributor: National Film Board of Canada, Ottawa, Ontario, Canada. Technical data: 16 mm., black and white, sound, 10 minutes. In English.

Salmon fishery of British Columbia, Canada, and the canneries that are set up along the coast to deal with the tremendous supply. The canning operations are shown, quality control and inspection, and a number of cooked salmon dishes.

Current Fisheries Literature

Selected Publications

IEWS 6.3 PLANKTON UDC 593.7

JONES, N. S. *Cumacea* of the Benguela Current. 'Discovery' Reports 1955 (Cambridge University Press, Bentley House, 200 Euston Road, London, N.W.1). Vol. XXVII, pp. 279-92, illus. In English. Price: 6s. 6d.

Cumacea were taken only on the continental shelf and the richest hauls were all from depths of less than 150 m. It is assumed that the bottom-living *Cumacea* are forced up by the low oxygen concentration at the bottom. Altogether five species were found. Three of them are new and are described in the text.

IEWS 1.0141 FISHES - NORWAY UDC 597 (481)

KAMBS-LYCHE, H. Norges Matnyttige Fisk [Norwegian Edible Fish]. 1955 *Fiskeridirektoratets skrifter, Ser. Fiskeri* (Director of Fisheries, Bergen, Norway). Vol. 3, No. 4. 132 pp. In Norwegian.

Gives a very good summary of present knowledge of commercial fishes in northern waters. For nearly every important fish the following descriptions and data are given: (1) Norwegian catches from various waters and the comparative values from several other countries. (2) Geographical distribution of the species and various stocks. (3) Summary on the studies of the biology and ecology of the species. (4) Life history. This book is very useful for fisheries education and as a handbook for the scientists in related fields (e.g., the hydrographer).

IEWS 1.9 FISHES UDC 597.5

BRIGGS, J. C. A Monograph of the Clingfishes (Order Xenopterygii) 1955 *Stanford Ichthyological Bulletin* (Natural History Museum of Stanford University, Stanford, Cal., U.S.A.) Vol. VI, iv+224 pp., fig. In English.

A systematic account of the family Gobiesocidae and order Xenopterygii. The 92 known species of the group are described in standard pattern; about a third of the species are illustrated. Evolution of the family and its sub-families is discussed. Distribution is described, illustrated by maps, and its zoogeographic implications are given. Describing the primary purpose of the work, which is to discover the relations within a well defined group of fishes, and hence the course of evolution, and its secondary purpose, which is to provide material of value in marine zoogeography, the author writes:

U.S.S.R. *Studies on the Question of Salmon "Economy" in the Far East.* 1954. *East.* Akademija Nauk SSSR, Intiologitseskaja Komissija. Moscow. 207 pp., illus., diag. In Russian.

Discusses the biological, economical and fisheries technological problems of Pacific salmon off the Russian Pacific coast.

TYSSER, H. F. (Editor). *Fisheries Yearbook and Directory 1955.* British 1955. Continental Trade Press Ltd., 222, Strand, London. 444 pp., illus. In English.

A reference book containing information on fisheries industries in various countries. The contents include: British fishery research; fisheries industries of Denmark, Iceland, Western Germany; transport by rail and road; fish cookery; dictionary of fish names; list of trade journals of interest to fisheries industry; factory trawler *Fairtry*; new marine equipment, and who's who in the fisheries industry. Followed by a directory of fish exporters, curers, freezers, trawler owners, fish importers, fish canners, dealers of machinery and equipment for packing, supplies for fisheries, fisheries by-products, cold storage and transport.

There is also a list of trade marks and names and a buyers' guide and classified list of advertisers.

BAS, C., MORALES, E. and RUBIO, M. *La Pesca en España. I. Cataluña* 1955. Fisheries of Spain I. Catalonia. Consejo Superior de investigaciones científicas. Instituto de Investigaciones Pesqueras, Barcelona, Spain. 468 pp., illus., fig., tables. In Spanish.

The first of a series, this publication covers: physical conditions of fisheries; fishing boats and gear; marine productivity; the fishery; ports and fishing beaches; economics; present day fisheries. Also gives a bibliography and an alphabetical index.

DE JAGER, B.V.D. The South African Pilchard (*Sardinops ocellata*). 1954. Plankton Studies in and around St. Helena Bay, 1950/51. *Commerce and Industry*, Vol. XIII, No. 3. *Investigational Report* No. 17. Department of Commerce and Industries, Division of Fisheries, Pretoria, Union of South Africa. pp. 147-72, diag., tables. In English. Price: 6d.

Investigations showed a marked decrease in the concentration of plankton from the coast seawards, and a positive correlation between the amount of plankton and the phosphate content of the surface layer. The principal food of the pilchard is phytoplankton, but during the autumn months when this is scarce, it feeds on copepods. A correlation was found between the stomach content of pilchard, and the composition of phytoplankton. In general, the settling volume of plankton in offshore waters was low during winter when the upwelling of deep nutrient waters decreased. An influx of fresh water from the Berg river appears to reduce the amount of plankton in the vicinity of the estuary. The presence of large quantities of phytoplankton in the commercial fishing area probably indicates feeding pilchards. The paper discusses seasonal changes in the abundance of important phyto- and zooplankton genera.

- U.S.S.R. 1953 *Work of All-Union Conference on Questions of Fisheries, Fisheries Management (Problems of Dynamical Enumeration of Fish, Fishing Prognoses, and Reproduction of Fish Stocks)*, 17-26 December, 1951. Akademija Nauk SSSR, Ihtiologitseskaja Komissija. Moscow. 602 pp., fig., diag., tables. In Russian. List of contents: I. Addresses to Conference, pp. 3-18; II. Reports and Discussions on the Problems of Enumeration of Fish and Fishing Prognoses, pp. 19-150.

DEMENTJEVA, T. F. Fluctuations in Numbers of Fish and Methods of Prediction of Fishing Results, pp. 19-36.

SEMKO, R. S. On the Causes of Fluctuations in the Amount of Pacific Salmon and the Problems in the Rational Use of Stocks, pp. 37-60.

BIRMAN, I. B. and LEVANIDOV, V. J. On the Dynamics and Reproduction of Salmon in the River Amor, pp. 61-76.

NIKOLJSKII, G. V. Fundamental Theoretical Work on Dynamical Enumeration of Fish, pp. 77-93.

VASNETSOV, V. V. Development of Mathematical Law in Dynamical Enumeration of Fish, pp. 94-98.

SVETOVIDOV, A. N. Unknown Factors Relating to Enumeration of Herring, pp. 99-109.

PROBATOV, A. N. Problems of Enumeration of South-Sakhalin Herring, pp. 110-23.

KARPEVITS, A. F. The Feeding Condition of Southern Sea Fish after Re-entering Rivers, pp. 124-50.

Discussions, pp. 151-236.

III. Reports and Discussions on Problems of Reproduction of Fish Populations.

KOCZIN, N. I. Problems of Scientific Research Work on Reproduction of Fish Stocks in Southern Waters, in Connection with Hydroelectric Constructions, pp. 237-53.

TARASJUK, B. F. Conditions and Perspectives of Work on Reproduction of Fish Stocks in Soviet Waters, pp. 254-65.

DERCZAVIN, A. N. Methods of Obtaining Mature Eggs from Sturgeon and Salmons, pp. 266-90.

GERBILJSKII, N. L. Intrinsic Biological Periods in Sturgeon and Significant Information for Development of Sturgeon Stocks in Connection with Hydro-Construction, pp. 291-300.

SADOV, I. A. Methods of Egg Incubation and Artificial Rearing of Sturgeon, pp. 301-24.

EMELIJANOV, S. V. Effect of Washing out Eggs of Sturgeon on its Development, pp. 325-39.

TSERFAS, B. I. Method of Rearing Young Fish, pp. 340-45.

SURKOV, P. G. Experiences in the Rearing of Fish in the Volga Estuary, pp. 346-53.

DISLER, N. N. Ecological-Morphological Factors in Growth of Autumn Keta (*Oncorhynchus keta* Walb.) in Amur, pp. 354-62.

KARZINKIN, G. S. Evaluation of Live Food for Fish and Mass Culture Methods, pp. 363-74.

Discussions, pp. 375-486.

IV. Reports and Discussions on Problems of Biological Productivity of Waters.

VODJANITSKII, V. A. On Problems of Biological Productivity of the Sea and its Importance for Fisheries Economy, pp. 487-508.

KARZINKIN, G. S. Biological Productivity of Inland Waters, pp. 509-28.

ZENKEVICH, L. A. Regarding Protection of Fish Food Resources in Sea Water, pp. 529-37.

KUZNETSOV, V. V. On the Ways of Increasing Fish Food Production in the White Sea, pp. 538-54.

Discussions and summary, pp. 555-99.

FWS 9.15

FISH DISEASES

UDC 639.2.09

SCHÄPERCLAUS, P. W. *Fischkrankheiten* [Fish Diseases]. 3rd ed. Aka-1954 demie-Verlag, Berlin. 708 pp., illus., fig., tables. In German.

Comparing this with earlier editions, the text and illustrations have been more than doubled. An introduction has been added describing the methods of research and diagnosis, etiology, pathogeny, pathology, prophylaxis and therapy of fish diseases.

As in earlier editions, the main emphasis is put on the most common and important diseases and parasites of cultivated, and fresh water, species in general, but those of sea fish are also discussed. A complete up-to-date account of prevention and cure is given by a description of diseases commonly found in fish culture.

Apart from those concerning the anadromous species, this remains the most important handbook on fish diseases for fish culturists and fresh water fisheries biologists. Although a complete account of all observed fish diseases in marine environment is not given, most of the known marine fish diseases and parasites are included.

Relatively few articles in the English language, particularly American articles, are considered; this edition is best read, therefore, in conjunction with *Culture and Diseases of Game Fishes*, by H. S. Davis, University of California Press, U.S.A., 1953.

FWS 9.16

FISH CULTURE

UDC 639.3

DAVIS, H. S. *Culture and Diseases of Game Fishes*. University of California Press, Berkeley and Los Angeles, Cal., U.S.A. x + 332 pp., illus., diag. In English. Price: U.S. \$5.00.

A practical handbook for fish culturists, gives a comprehensive account of methods commonly used in the artificial propagation of fish, the main emphasis being on salmonids, especially trout. Part 1 describes the location and building of hatcheries, the propagation, care and rearing, and artificial food. Principles of pond culture are discussed. Part 2 is devoted to fish diseases and is written for the fish culturist with no special training in fish pathology. Apart from some very rare and comparatively unimportant diseases, all the major aspects of this field are discussed. Written for American conditions, this book is of equal value to fish culturists in northern and central Europe.

Ročníšná výroba a veterinární medicína [Animal Production and Veterinary Medicines]. Collected publications of the Czechoslovak Academy of Agricultural Sciences, Vol. 28, No. 5, May 1955. In Czech. Price: 10 Kcs. Prague, Czechoslovakia.

ČERNAJEV, V. and BENA, J. Podklady pro stanovení výrobní rybářské normy [Basis for Determining Fish-cultural Targets], pp. 347-56.

PAULÁT FRANT., and PAULÁT, M. Přístroje proti zamrzání prohlubní na komorových rybnících [Devices to Prevent Freezing up of Openings in Compartment Ponds], pp. 357-62.

VÁCLAVÍK B. Rybářský profil vodního moru a jeho hubení [Fish-cultural Profile of *Anacharis canadensis* Planch (or *Elodea canadensis* Rich) and its Distribution], pp. 363-74.

DYK, V. Příspěvek k topografii a váze vnitřnosti ostrořetky stěhovavé [A Contribution to the Topography and Weight of the Intestines of *Chondrostoma nasus* Linn. 1758], pp. 375-84.

TUČEK J. O potravě pstruha obecného (*Salmo trutta morja fario* L.) a její přístupnosti v předjarních měsících v řece Moravici [On the Food of the Trout (*Salmo trutta morja fario* L.) and its Accessibility in the Early Spring Months in the River Moravice], pp. 385-94.

VOLF, F. and SMÍŠEK, J. Uhor v československých vodách [Eel in Czechoslovak Waters], pp. 395-410.

ŠTĚDRONSKÝ, E. O potravě mníka obecného (*Lota lota* L.) v Teplé Vltavě [Food Consumption of the Common Eel Pout (*Lota lota* L.) in the Teplá Vltava River], pp. 411-22.

PODUBSKÝ, V. Střevní dýchání pískore pruhovaného (*Misgurnus fossilis* L.) mřenky mramorované (*Nemachilus barbatulus* L.) a sekavce obecného (*Cobitis taenia* L.) [Intestinal Respiration of *Misgurnus fossilis* L., *Nemachilus barbatulus* L. and *Cobitis taenia* L.], pp. 423-432.

LUCHÝ, Zď. Příspěvek k bionomii, pathogenitě a rozšíření cizopasných zábrohlístů na jižní Moravě [A Contribution to the Bionomics, Pathogenesis and Distribution of Parasitical *Monogenoidea* in S. Moravia], pp. 433-40.

S.S.R. *Studies on Problems of Acclimatization of Fish and Its Food* 1954 *Invertebrates*. Akademija Nauk SSSR, Ihtiologitseskaja Komissija. Moscow. 183 pp., fig., tables. In Russian.

Contains articles on methods and results of transplantations of fish to the U.S.S.R. The biological background of transplantations, and the role in changing the environmental conditions, as well as the reeking of artificial lakes (hydro-reservoirs), are discussed.

